

MACHINERY

Design—Construction—Operation

Volume 41

AUGUST, 1935

Number 12

PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 776-B

September MACHINERY will contain a Special Section dealing with the National Machine Tool Show that will be held in Cleveland September 11 to 21—the largest industrial exposition ever held in America. Many of the new machines and devices exhibited at the Show will be illustrated and described, and there will be other unusual features of special interest to men engaged in the mechanical field. The regular departments will be included.

| | | |
|--|--------------------|-----|
| Unusual Jobs on Keller Machines..... | By Charles O. Herb | 713 |
| The Blanking and Drawing of Thin Stock..... | | 719 |
| Die-Casting with Machines of Simple Design | By Charles O. Herb | 721 |
| Editorial Comment | | 728 |
| Appearance and Utility Harmonized in Today's Machine Design— Sound Castings are the Result of Team-Work | | |
| Some Machine Tools of the Past Century..... | | 732 |
| Charts for Calculating Worm-Gear Loads..... | By John H. Will | 738 |
| A. H. Tuechter Completes Fifty Years with the Cincinnati Bickford Tool Co. | | 747 |
| Use of Haynes Stellite J-Metal for Machining Lycoming Motors | | 748 |

DEPARTMENTS

| | |
|--------------------------------------|-----|
| Engineering News Flashes | 726 |
| Ingenious Mechanical Movements | 729 |
| Questions and Answers | 742 |
| Design of Tools and Fixtures..... | 743 |
| Materials of Industry | 750 |
| New Trade Literature | 753 |
| Shop Equipment News | 755 |
| News of the Industry..... | 775 |

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street New York
ROBERT B. LUCHARS.....President
EDGAR A. BECKER..Vice-pres. and Treasurer
ERIK OBERG.....Editor
FRANKLIN D. JONES.....Associate Editor
CHARLES O. HERB.....Associate Editor
FREEMAN C. DUSTON....Associate Editor

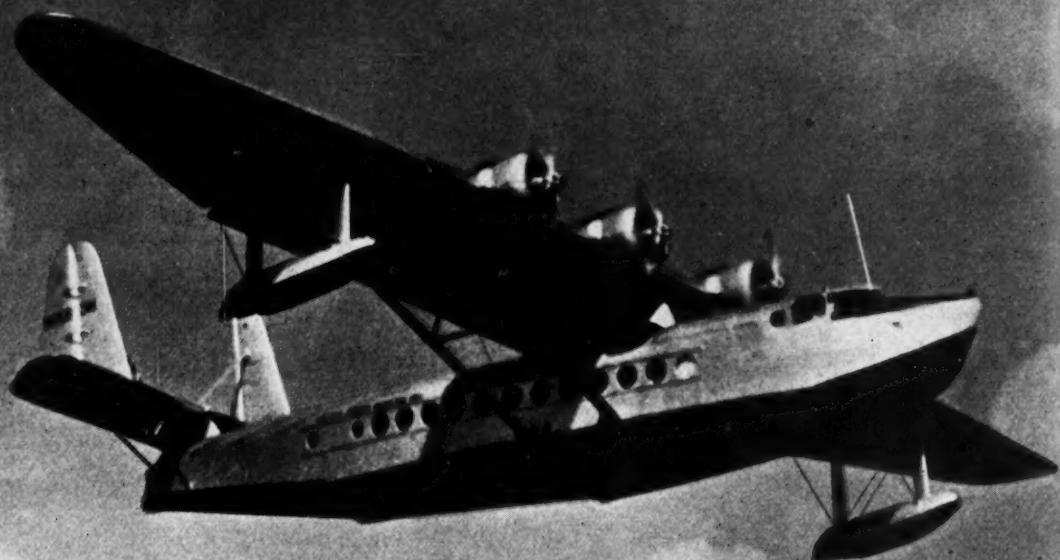
LONDON: 52-54 High Holborn
PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, \$3 (two years, \$5); foreign countries, \$6. Single copies, 35 cents. Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue. Send old as well as new address.

Copyright 1935 by The Industrial Press. Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America.

Product Index 94-110

Advertisers Index 112



FLYING DOWN

| | |
|-------------------------|-----------------------|
| DRILLING LATHES | GAP LATHES |
| ★ | ★ |
| CRANKSHAFT LATHES | PORTABLE LATHES |
| ★ | ★ |
| TOOL ROOM LATHES | DUOMATIC LATHES |
| ★ | ★ |
| MANUFACTURING LATHES | OIL COUNTRY LATHES |

AT THE
MACHINE TOOL
SHOW
CLEVELAND
SEPTEMBER 11-21

*Be sure to see our complete
exhibit at Booth No. 1018.*

Down to South America. A land of incredible bigness, where a small ranch is as big as New Jersey. And where the sales potentialities of expanding industry and the building of empire is attracting every manufacturing country in the world.

Connected with the United States and Europe by the first regular transoceanic airplane and dirigible routes; coming into the limelight as a producer of cotton; long a mining center—South America is going places in many big ways.

In South America's growing industrial lineup, Lodge & Shipley Lathes have significant representation—their choice by many South American Plants, on a basis of comparison, proves that South America agrees that—*The World Turns Best on Lodge & Shipley Lathes.*

The Lodge & Shipley Machine Tool Co.
CINCINNATI, OHIO, U. S. A.

LODGE &

MACHINERY

Volume 41

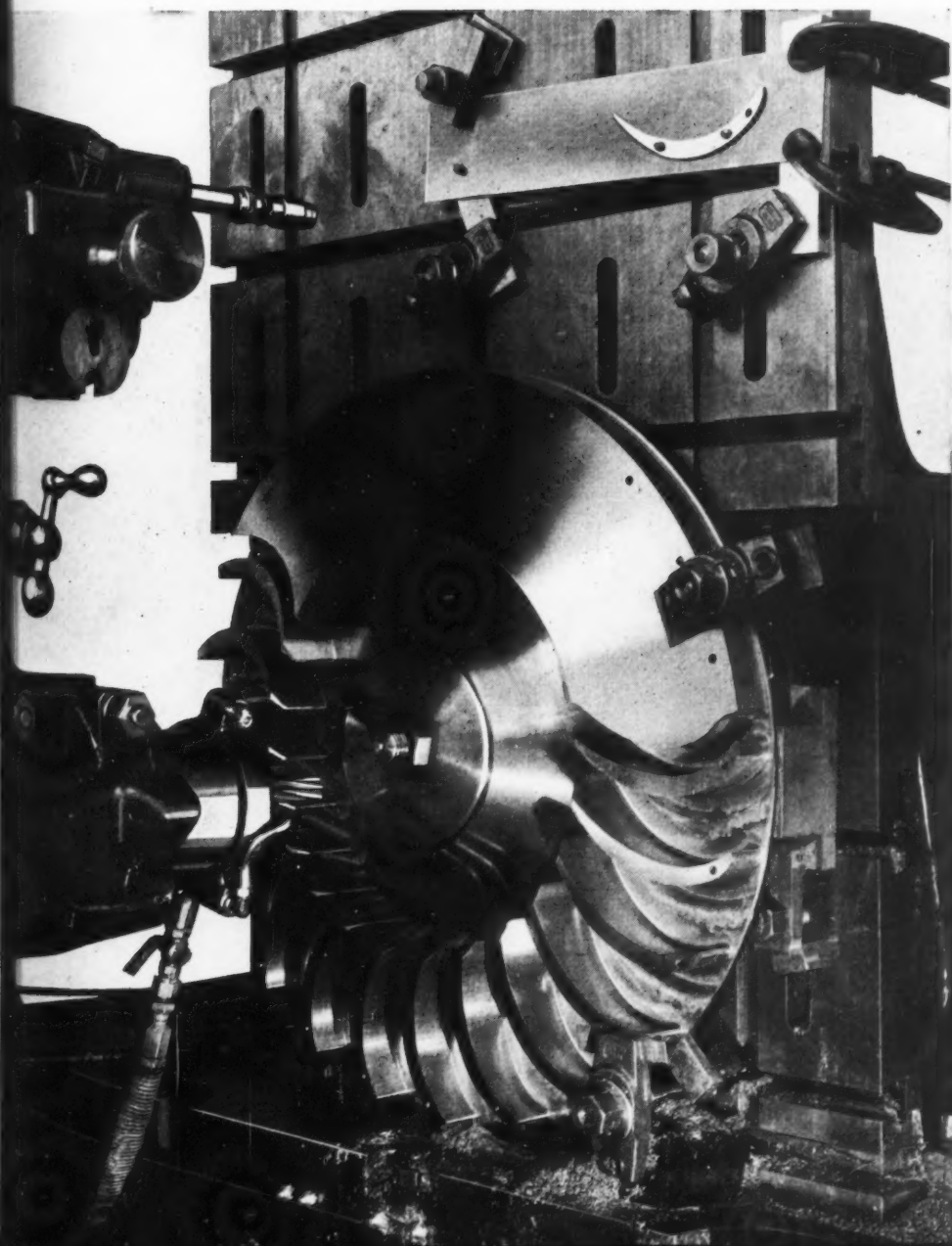
NEW YORK, AUGUST, 1935

Number 12

Unusual Jobs on Keller Machines

While the Automatic Tool-Room Machine is Most Widely Used on Dies and Molds, it is Also Applicable to Many Manufacturing Jobs

By CHARLES O. HERB



WORK of any irregular shape, whether it must be machined in two or three dimensions, can be closely milled to the desired contour on Keller automatic tool-room machines. For this reason, these machines are being widely utilized in making dies for stamping, extruding, forging, and die-casting; molds for plastic materials; metal patterns; and similar products of the die shop or tool-room. Small extrusion dies with slots as narrow as 0.080 inch and huge automobile body die parts weighing as much as 24 tons apiece are handled on machines of this type. Jigs and fixtures are also within the scope of the machines, as they can bore to close center distances and mill flat or irregular surfaces in the same set-up. The machines are built in several sizes to meet varied requirements.

While these machines are well-known equipment in the tool and die shops of the automobile, silverware, and

Machining the Vanes of a Turbine Impeller from a Solid Steel Forging

other industries, their applicability to handling many jobs in the manufacturing divisions of industrial plants is not fully appreciated. This use of the machines will be stressed in the present article.

On Keller automatic tool-room machines the tool is accurately guided over the work piece in accordance with the movements of a similarly shaped tracer over a templet or master that is mounted directly over the work on the same vertical fixture. The master and work are held in a fixed relation to each other, while the tracer and cutter are also maintained in a fixed relation.

On some Keller machines the work is movable horizontally and transversely and the head vertically, while on other types, the work is stationary and all three motions are performed by the head. All motions are obtained through lead-screws which are driven by constantly revolving electromagnetic clutches. These clutches are energized and de-energized under the control of the tracer, with the result that the movement of the lead-screws, when the machine is being operated automatically, is such as to keep the tracer always in contact with the model, thus reproducing the shape of the model on the work.

When the machine is performing a profiling operation, the cutter and tracer are set to a given depth and the transverse motion is inoperative. When it is milling a job in all three dimensions, the machine is set to make a series of parallel strokes,

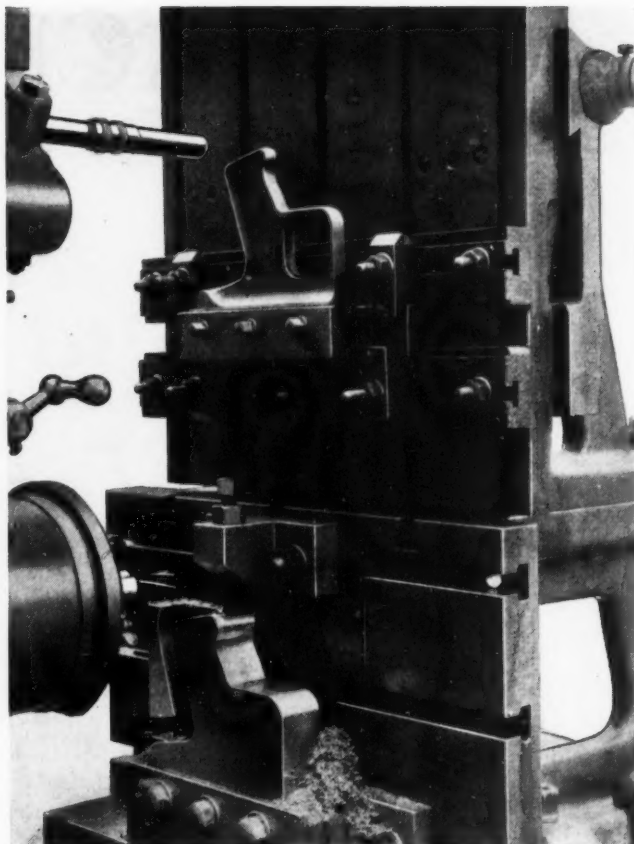


Fig. 1. (Above) The Automatic Tool-room Machine Provides a Convenient Means of Reproducing Parts Experimentally before Expensive Dies are Made for Their Manufacture on a Production Basis

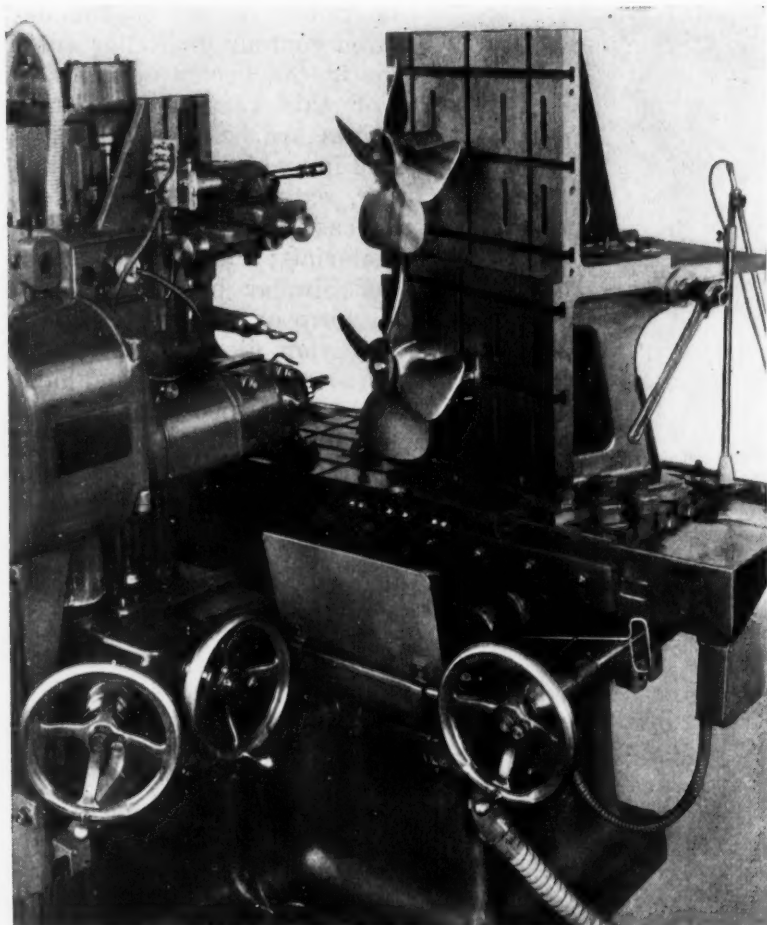


Fig. 2. (Left) Automatically Milling the Blades of a Boat Propeller by Using a Finished Propeller as a Master for the Tracer that Governs the Cutter Movements of Keller Machines

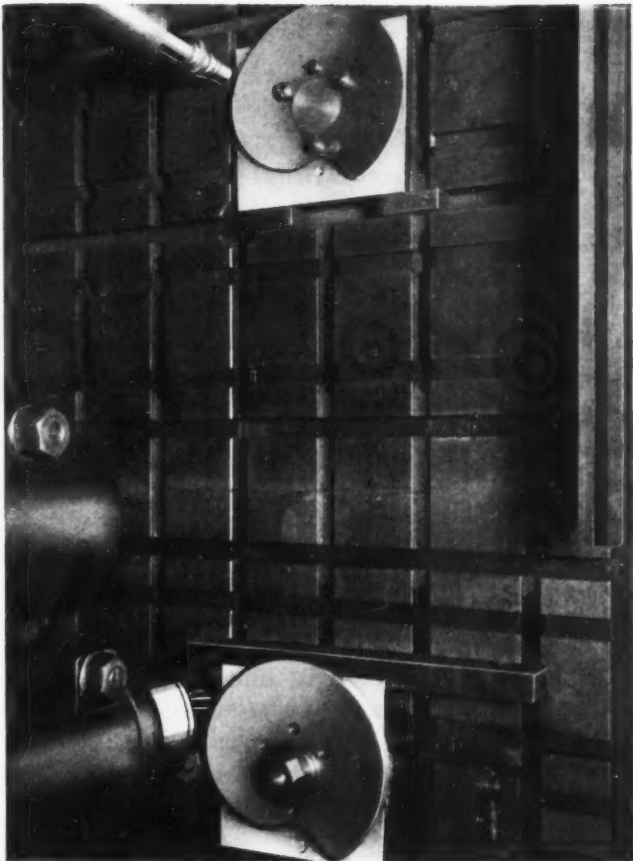
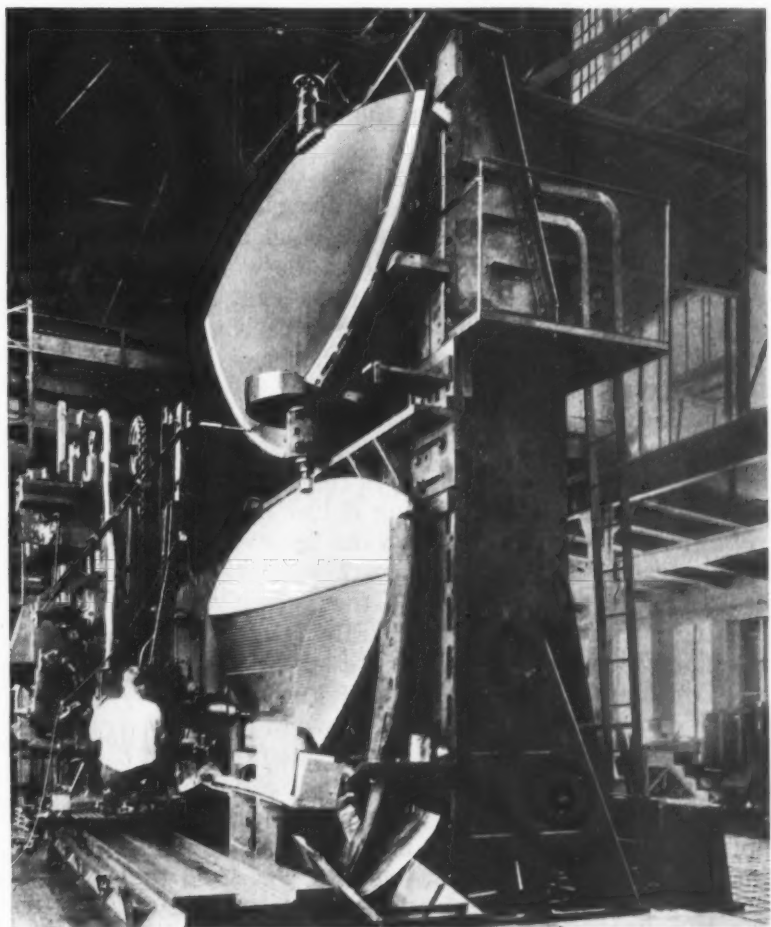


Fig. 3. (Above) The Milling of a Profile Cam Requires Merely a Simple Sheet-metal Templet of the Desired Outline. A Cam 6 1/2 Inches in Diameter and 3/8 Inch Thick can be Milled in 35 Minutes

Fig. 4. (Right) A Turbine Blade 5 1/2 Feet High by 10 Feet Wide Being Accurately Milled to the Required Curvature by Means of a Wooden Pattern on a Keller Automatic Tool-room Machine



either vertical or horizontal. At the end of each stroke, the motion is reversed, and at the same time, the machine feeds a predetermined amount to be ready for the next stroke. The tracer controls the transverse motion to suit all the varying depths, and at the same time, stops the travel of the machine when it is necessary to come down or up on a straight side.

The tracer is so sensitive that on many types of work a movement of less than 0.001 inch as it bears against the master will vary its direction of travel, regardless of the size of the cutter, the depth of the cut, or the hardness of the material.

Complicated Vanes of Turbine Impellers Produced from a Simple Templet

The heading illustration shows an operation being performed on a Keller machine that would present a difficult problem for a shop not provided with this type of equipment. The job consists of machining the vanes of a 23-inch turbine impeller from a solid steel forging. This forging came to the machine turned and faced to size, with a series of bolt holes, one for each vane, around the edge. These holes were produced on a jig-boring machine, so as to provide an accurate means of indexing during the vane-milling operation. The turned and bored blank was mounted on a cylindrical stud attached to the vertical platen of the machine. A simple crescent-shaped templet for guiding the tool

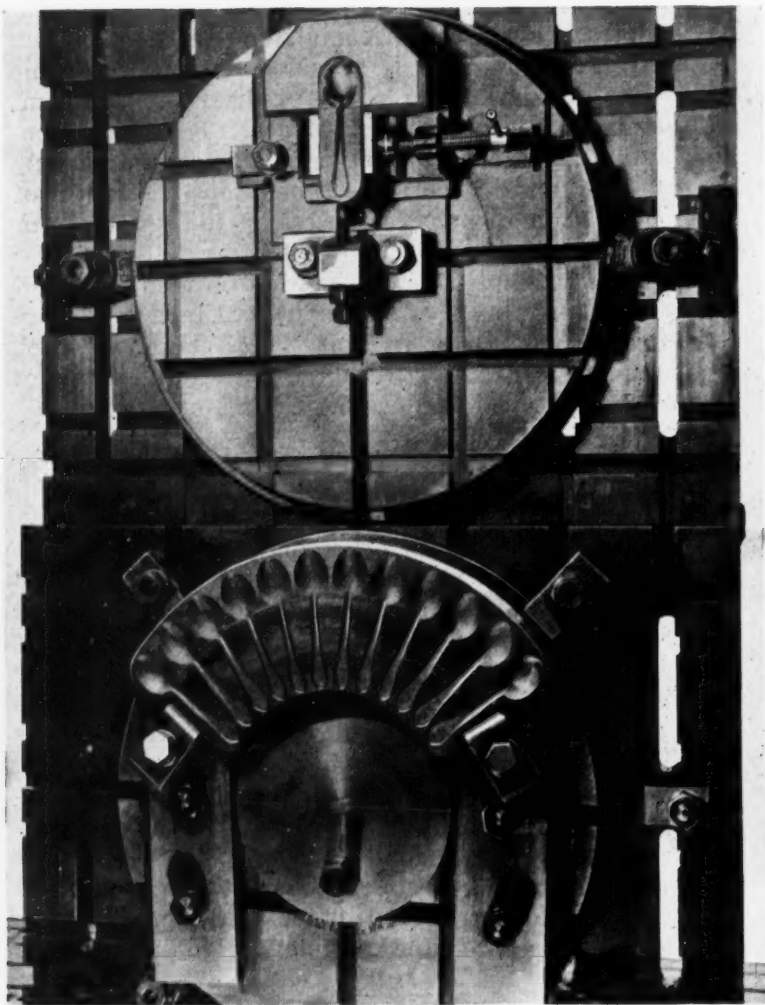


Fig. 5. Multiple Numbers of Impressions or Cavities in Plastic Molds Can Easily be Reproduced from a Single Templet

tuted. The milling of all twenty-four of the impeller vanes was accomplished in forty-five hours.

Boat propellers are good examples of irregular shaped parts that require in and out movements of a cutter in addition to vertical and sidewise movements. In Fig. 2, a propeller forging about 14 inches outside diameter is being milled to the required shape by using a finished propeller as a master. The tracer automatically follows the contour of the master in and out as it travels up or down and these in and out movements are, of course, imparted to the milling cutter. At the end of each vertical movement of the cutter and tracer head, the work-table on which the model and work are mounted moves horizontally to give a predetermined width of cut for the next vertical stroke. In this way, the entire surface is covered and every contour reproduced. Only one blade of the propeller is used as a master, the work itself being indexed. Thus, perfect

matching of all four blades is accomplished.

If a finished propeller had not been available for guiding the cutter in this operation, a wooden pattern or a plaster cast could have been used. After the propellers leave this machine, they are smoothed up by using a flexible-shaft grinder equipped with sanding drums.

Large Turbine Blades Accurately Milled

Large blades for turbines are milled by the S. Morgan Smith Co., York, Pa., in the manner shown in Fig. 4. The turbine blade on the machine illustrated is 5 feet 6 inches high by 10 feet wide, and the curvature or sweep is approximately 18 inches between the high and low points. Five blades of this type are mounted in a common hub, and it is essential that all five blades be in good balance. The blades are steel castings.

The blades and wooden master are so high that a special structure had to be erected for supporting them. Also, the blades are too large to be machined in one set-up, and so each blade is finished for one-half its height and then lowered on the platen and reclamped for milling the remaining half. When the castings come with a good deal of stock allowed for finishing, the practice is to take a roughing cut, as shown in the illustration, and then a finishing cut, after which the

Fig. 6. Milling a Series of Accurate Locating Surfaces on a Solid Steel Block for a Die-casting Die for Automobile Radiator Grilles

blade is removed from the machine and smoothed with a hand grinder. When the castings come close to finished size, a single finish cut is all that is necessary. Chips from the milling operation are carried by the coolant into the trough seen in the foreground.

The Making of Experimental Parts is Another Function of Keller Machines

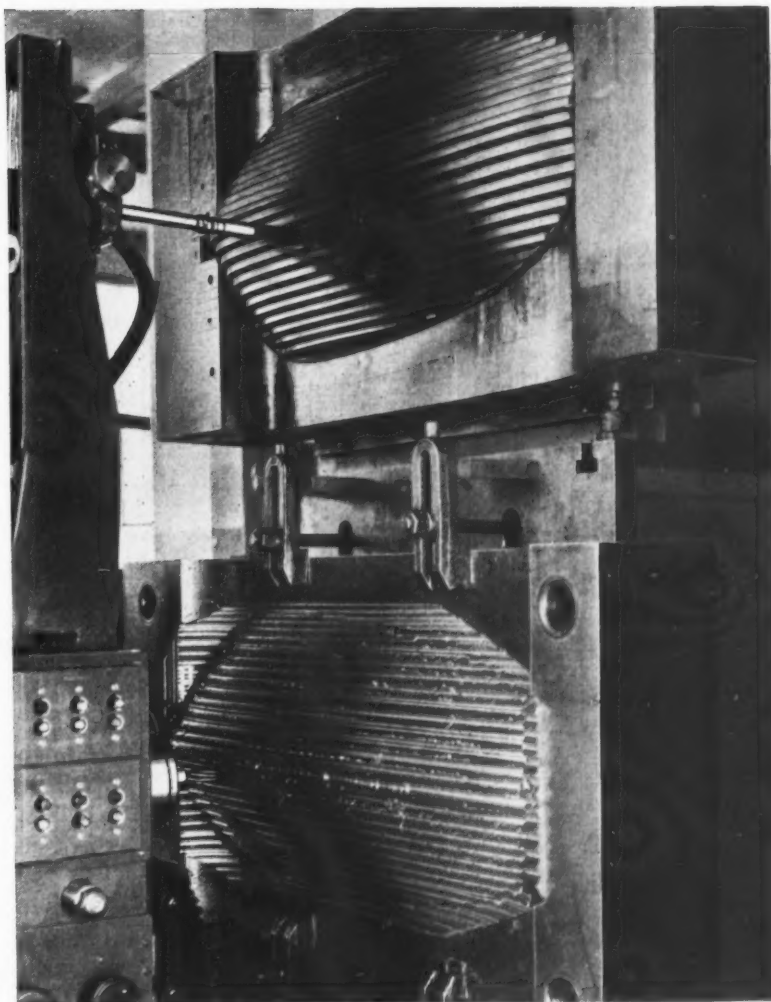
Economy demands that the exact shape and dimensions of forgings, stampings, die-castings, etc., be determined upon before expensive dies are made for their production. It is the practice, therefore, in most shops to first make one or more such parts by other means, in order that the manufacturer may actually see how a proposed part will look, feel, and otherwise serve the purpose for which it is intended. The automatic tool-room machine is especially adapted to the production of such experimental parts.

In Fig. 1 is shown an automatic pistol body being milled from a solid block of steel. When completed, the thickness of the handle web was only 0.040 inch. Bodies varying slightly in shape and dimensions were made from different masters until one of the desired "feel" was obtained. The milling of each body took about fourteen hours, but much more time would have been consumed in making them on machines not equipped for reproducing the irregular contours automatically. The master was made of wood.

Cams of profile and track types can be easily reproduced from existing cams or similar templets. In Fig. 3, a cam of the profile type is being milled from a sheet-metal templet. About thirty-five minutes was required for this job, the cam being 6 1/2 inches maximum diameter and 3/8 inch thick. Cam blanks may be square, round, or of irregular shape, and the excess material easily milled away.

Single Templets Used in Milling Duplicate Mold Impressions

Molds used for producing small parts from synthetic plastics are generally made with a number of duplicate impressions, so that the parts can be molded in multiple. All of the impressions can usually be milled on the automatic tool-room machine by employing a single model or templet for guiding the milling cutter. A completed mold of



this type designed for producing twelve spoons at a time is shown in Fig. 5. Both the model and the mold casting are mounted on circular tables fastened to the vertical platen of the machine.

In this operation, the work-table is indexed upon the completion of each impression, so as to position the work correctly for milling the succeeding impression. The table is clamped securely after each indexing. A graduated scale on the periphery of the table enables accurate settings to be made. The impressions in the matching half of the mold were also milled on this machine after a suitable model had been substituted for the one shown.

Milling a Large Die-Casting for a Complete Automobile Radiator Grille

In making die-casting dies, the accurate machining of locks or parting lines is often of more vital importance than the machining of the impression itself. Fig. 6 shows a Keller machine being employed to produce the parting line of a die designed to cast the Oldsmobile radiator grille. This grille is a single die-casting that measures approximately 36 inches in length by 16 inches in width. The grille slopes from the side to the center, forming a vee that is about 5 1/2 inches high.

The illustration shows how complicated the part-

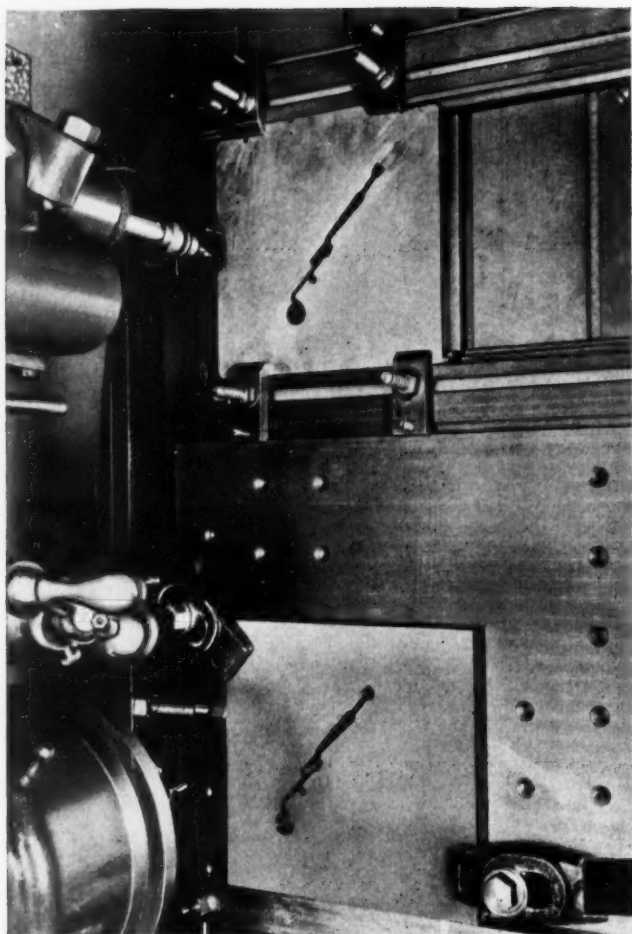


Fig. 7. Many Dies are Milled on Keller Machines because the Delicate Cutters can be Run at the Required Feeds and Speeds without Breakage

Fig. 7 shows a typical job on a blanking die that required a cutter of comparatively small diameter. The over-all length of the slot is 5 inches, and at the narrowest point it is about 1/8 inch wide. It was milled with a cutter 0.100 inch in diameter. The die is 7/8 inch thick, of which 9/16 inch was cut straight through from the front. The die and templet were then turned over, and the back of the impression relieved with an angle cutter.

Right- and Left-Hand Parts Produced from One Templet

In addition to the automatic tool-room machines, the concern builds a line of reducing machines that will mill parts with various amounts of reduction relative to the master. Certain of these machines are provided with a feature whereby the reductions in length, width, and thickness may be made disproportionate to one another. Such a machine has been of considerable value to a manufacturer of shoes with built-in arch preservers. After a standard shape of arch preserver had been decided upon, a master was constructed, and this single master was used to mill a separate forming die to correspond with each of the many lengths and widths in which shoes are made.

After a die had been milled for a right-hand arch preserver, this die was used as a model on an automatic tool-room machine for reproducing a left-hand die of the same dimensions and shape. For this work, the standard Keller machine was equipped with an attachment provided with a slide for mounting the templet. In the process of milling a right-hand part from a left-hand model, the templet slide moves horizontally with the feeding of the milling cutter, but in the opposite direction.

The blanking dies and punches were also produced on the Keller automatic tool-room machine. A single sheet-metal templet was used for the right- and left-hand die of each pair, and consequently, true symmetry was insured.

* * *

All too often we read of a man establishing a brilliant success, while another man with the same ideas, or perhaps better ideas, is left behind, simply because he did not have the power to make a decision and adhere to it. A man who cannot decide, and who simply drifts along with the strongest current, rarely, if ever, achieves success.—*Tool Tips.*

ing line is on these dies. Unusual accuracy was required, in order to eliminate any possibility of flash and consequent expensive hand-finishing on the castings. A hard wood master was employed, and the parting line surface was milled out of solid steel inserts in the die-block. The work was done for the Precision Castings Co., Syracuse, N. Y., who subsequently finished the dies and milled the impressions for the ribs of the radiator grille with form cutters, using as guides the parting line surfaces previously finished on the Keller machine.

Large Range of Die Work that Can be Handled

At the beginning of this article it was pointed out that Keller machines are applicable to the machining of both large and small dies. The use of machines of this type for shaping the dies employed to produce automobile bodies was fully described in an article published in February, 1934, *MACHINERY*, page 321. The other extreme in the range of work handled by the machines is small blanking and extrusion dies. In such work, cutters as small as 0.080 inch in diameter are being regularly used, as already pointed out, while still smaller cutters have been used experimentally. The machines can be operated automatically at the proper feeds and speeds for such delicate cutters, whereas on a manually fed machine so much pressure would be placed on them that they would break.

The Blanking and Drawing of Thin Stock

SHEET-METAL blanking and drawing practice is based almost entirely on empirical rules that do not adequately cover the handling of thin stock—that is, stock not exceeding 0.025

inch in thickness. Most available tables do not give the blanking pressure for stock below 0.025 inch in thickness, the blanking pressure being taken as the shear stress of the material multiplied by the length of cut times the thickness of stock, assuming that the die has no shear. In practice, when the die has proper shear and clearance and is in reasonably good condition, the blanking pressure will be about half that shown by this rule.

Thus, for thin stock of the usual mild steel material having a shear stress of 50,000 pounds per square inch, 25,000 should be substituted for 50,000 in the rule when calculating the pressure actually required for blanking the stock. This gives the formula:

$$B = 25,000 \times P \times t$$

in which B = blanking pressure;

P = perimeter, or length of cut; and

t = stock thickness.

Applying this formula, the approximate blanking pressures for cuts 1 inch in length in mild steel stock having thicknesses ranging from 0.0080 to 0.0250 inch are given in the accompanying table:

| Stock Thickness, Inch | Blanking Pressure per Inch Cut, Pounds |
|-----------------------|---|
| 0.0250..... | 625 |
| 0.0205..... | 512.5 |
| 0.0180..... | 450 |
| 0.0155..... | 387.5 |
| 0.0125..... | 312.5 |
| 0.0110..... | 275 |
| 0.0100..... | 250 |
| 0.0090..... | 225 |
| 0.0080..... | 200 |

For aluminum and brass stock, in which the shear stress is 35,000 pounds per square inch, pressures should be reduced accordingly; that is, 17,500 should be substituted for 25,000 in the formula given. These pressures are never very high, and consequently, such factors as the degree of penetration, bolster load and center of blanking pressure assume less importance in blanking thin stock. Thus, if the dies are made with ample shear, very light presses can be used for blanking thin stock such as referred to here.

Thin stock is usually more difficult to draw to any depth than thick stock. In drawing a circular shell from a flat blank, for example, two main

A British Tool Engineer Points Out the Factors to be Considered in Handling Sheets Less than 0.025 Inch Thick

stresses are involved—one a tensile stress in the wall material, and one a compression stress in the flange material. The thinner the stock, the greater the liability of fracture.

The flange stress tends to wrinkle the flange, so that pressure from some form of buffer is required to hold it flat. The thinner the stock, the greater is the tendency to wrinkle and so the greater must be the pressure exerted by the buffer. Consequently, the thinner the stock, the less it can be drawn. It is the writer's belief that such points are not sufficiently emphasized in text-books on die design.

The theoretical minimum shell diameter d that can be drawn from a fixed blank diameter D is $D \div 2$. In practice, such a reduction can never be realized in the case of thin stock. A safe minimum diameter d for thin stock is equal to $D \div 1.6$, and if an ordinary rubber buffer is to provide the pressure in a single-acting die, a safer figure would be $D \div 1.55$. This is, of course, intended for general application to thin stock of the range given in the accompanying table, and needs modification for changes in important factors, such as the type of die, the kind of material, etc. This data can be accepted, say, for tin plate from 0.009 to 0.015 inch thick, using a single-acting die.

With double-acting dies or constant-pressure devices, the minimum diameter d might be decreased to equal $D \div 1.7$ for tin plate of the thickness referred to, assuming that it is of the commercial deep stamping quality. One important point to note is that the quality of thin stock varies more than thicker stock, largely because the final annealing cannot be carried out so uniformly.

Another point of some importance is the corner radius of the shell. From the drawing standpoint, the greater this radius, the greater is the permissible draw. Shells with a large radius can be drawn from soft steel stock about 0.018 inch thick to a depth equal to the diameter of the shell with comparative ease. This point should be emphasized, because in many cases, the corner radius can be increased without any detriment to the finished shell. It might also be pointed out that the greater the thickness, the larger can be the drawing radius on the die, as the material will draw over this larger radius without wrinkling.

For the thinner stock, at the 0.0080 inch end of the range given in the table, the drawing radius should be kept as small as possible at the begin-

ning of the draw trials, and increased in the trial drawing operations slightly if necessary. A large radius for very thin stock necessitates the application of greater pressure on the blank to prevent wrinkles, so that any possible benefit from the increased radius is lost.

Percentage of Reduction in Redrawing Thin Stock

Thin stock cannot be redrawn so rapidly as thick stock. Authorities do not agree as to a general rule for the percentage of reduction. The maximum reduction from the first draw to the second ranges from 40 to 20 per cent, depending upon a number of variables. For thin stock, the maximum reduction per operation can seldom exceed 25 per cent, which can be used from the first draw to the second, and possibly, in certain cases, from the second to the third draw.

Beyond this, the reduction should be nearer 20 per cent. It is essential to note that if too much reduction is attempted in one operation, the metal will harden and will break down much more readily in subsequent operations. In redrawing stock, it is necessary to keep the percentage of reduction as low as possible. Omitting an operation at the expense of too large a percentage reduction may increase the percentage of waste or scrap from a normal 3 per cent to an abnormal 30 per cent. The reductions in diameter of the shell made in the concluding drawing operations should be much lower than 25 per cent.

Drawing Non-Circular Shells

In drawing non-circular shells in thin stock, it is wise to modify the empirical rule that the depth of draw on rectangular work may be six times the corner radius. For thin stock, the depth of draw should be more nearly four times the corner radius, and if the radius is very small, even less, especially in combination blanking and drawing dies. Much greater care must be exercised in planning drawing operations for non-circular shells than for those of circular shape. If there is considerable doubt regarding the proper design, the best practice is to make up a simple experimental die.

In redraw work, the amount left in the corners for redrawing should always be very small. In oval-shaped work, the drawing problem is best considered by assuming that the oval is made up of three portions of two cylindrical shells. The depth of draw is determined by applying the most conservative formulas for cylinder drawing to the two small cylinders at the ends of the oval shell.

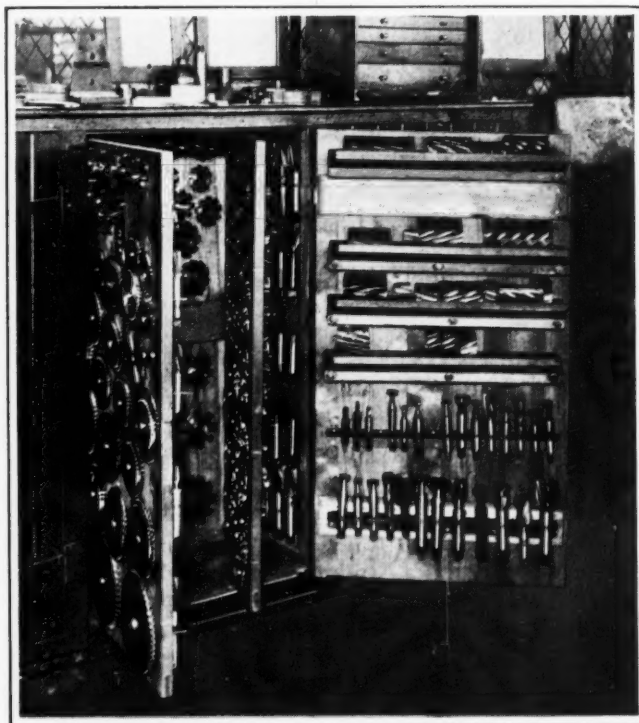
* * *

Air-conditioning of manufacturing plants will be one of the next steps in the improvement of working conditions. One large machine shop has already been equipped for air-conditioning.

A Cutter Cupboard without Lost Space

By OLIVER HERBERT

The tool-crib attendant in the machine division of the Grand Trunk Railway shops at Battle Creek, Mich., boasts of several tool cupboards in which practically every inch of space is used up. One of these cupboards is shown in the illustration. Not only are the rear and side walls and the inside of the door used for storing cutters, but there are also



Cupboard of Comparatively Small Size that Accommodates up to 1000 Cutters

two hinged panels which are equipped with hooks or racks on both sides for the same purpose. When these panels are folded back and the door is closed, there is obviously little lost space.

Each cupboard is approximately 28 inches wide, 16 inches deep, and 44 inches high inside. In this comparatively small space, from 700 to 1000 milling cutters and gear-cutters are ordinarily stored. Furthermore, they are stored in such a way that any cutter can be found at a moment's notice, clean and in good condition for immediate use. Within an enclosure of less than 11 1/2 cubic feet, there is over 60 square feet of space available for storing cutters.

* * *

Most of the difficulties encountered in solving our problems, said a well-known engineer, are due to the fact that we are seeking complicated solutions. We seldom seem to think of the obvious.

Die-Casting with Machines of Simple Design

Second of Three Installments Indicating the Production Possibilities of Comparatively Inexpensive Die-Casting Equipment

By CHARLES O. HERB

DIES illustrative of the economies that can be effected by die-casting small parts in semi-automatic machines, whether large or limited quantities are required, were described in the first installment of this article, which was published in July MACHINERY, page 669. One of the dies described in the previous installment produces 1600 lead battery bushings an hour, and another set casts bowl-shaped pieces that are used in pairs to form a universal ball.

The dies described in the first installment were made for use on the semi-automatic Kippcasters built by the Madison-Kipp Corporation, Madison, Wis. The present installment will describe three more dies designed for use on the same type of machine.

Dies are sometimes designed to cast several dif-

ferent pieces simultaneously in cases where the production required for any one piece is comparatively limited. Dies of this type are illustrated in Fig. 6. These dies cast the bowl-shaped fitting seen at the left in Fig. 7, the fitting cover at the right, and the threaded thumb-screw shown between these two parts. In Fig. 6, the movable die is shown at the left and the stationary die at the right.

The interesting features of this set of dies will be seen by reference to the sectional views, Fig. 8. The threads of the thumb-screw are produced by a steel insert which is placed in an opening in the face of the movable die when the dies are open, and is held in place by spring clips A on a block which is fastened to the movable die. One half of the thumb-screw

Fig. 6. Dies Used for Producing Three Different Die-castings at the Same Time

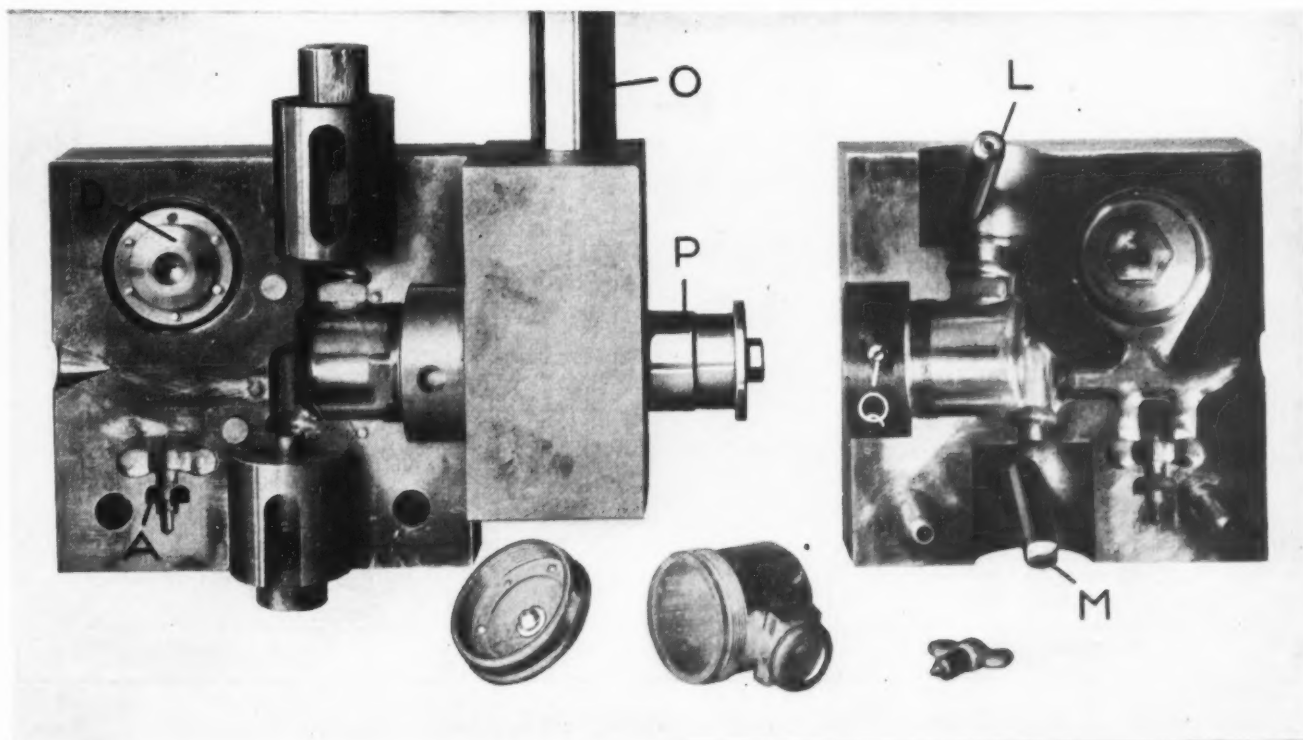
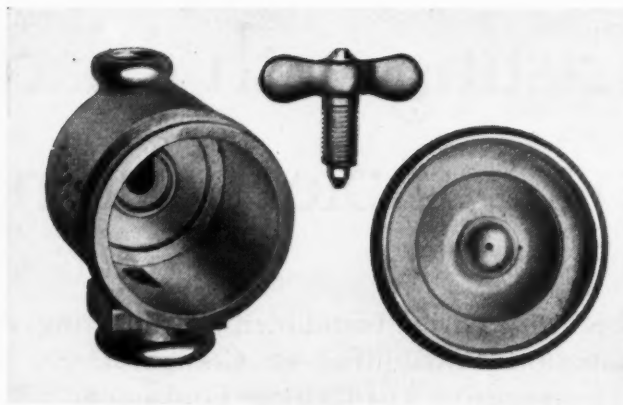


Fig. 7. The Three Parts Produced in Each Operation Performed with the Dies Illustrated in Fig. 6



on the fitting cover in Fig. 6 are cut by machine.

The fitting itself is of such design as to require three moving cores. Cores *G* and *H*, Fig. 8, are automatically pulled up and down as the movable die is withdrawn from the stationary die, due to the action of core-holders *J* and *K* sliding on pins *L* and *M*. Since

is formed in the stationary die and the other half in the movable member.

The fitting cover is formed as shown in the upper view of Fig. 8. A hole $\frac{1}{16}$ inch in diameter is produced by core *B*, which is mounted in the center of the larger core *C* of the stationary die. The internal surfaces of the cover are shaped by core *D* of the movable die, while the outside surfaces are produced by die-blocks *E* and *F* of the movable and stationary dies, respectively. It will be noted that core *B* extends into a close fitting hole in core *D*, thus preventing the formation of flash around the $\frac{1}{16}$ -inch hole. The threads seen

both of these pins project at an angle from the face of the stationary die, they produce vertical movements of core-holders *J* and *K*, which are, of course, mounted on the movable die. The two core-holders are retained in the raised and lowered positions by spring detents.

The large core *N* which shapes the inside of the bowl is withdrawn from the finished casting by turning shaft *O* with a long handle that fits in the hole provided near the upper end. Pinion teeth on shaft *O* engage rack teeth on the back of core-holder *P* and thus move the holder and core *N* laterally when shaft *O* is turned. Pin *Q*, Fig. 6, on

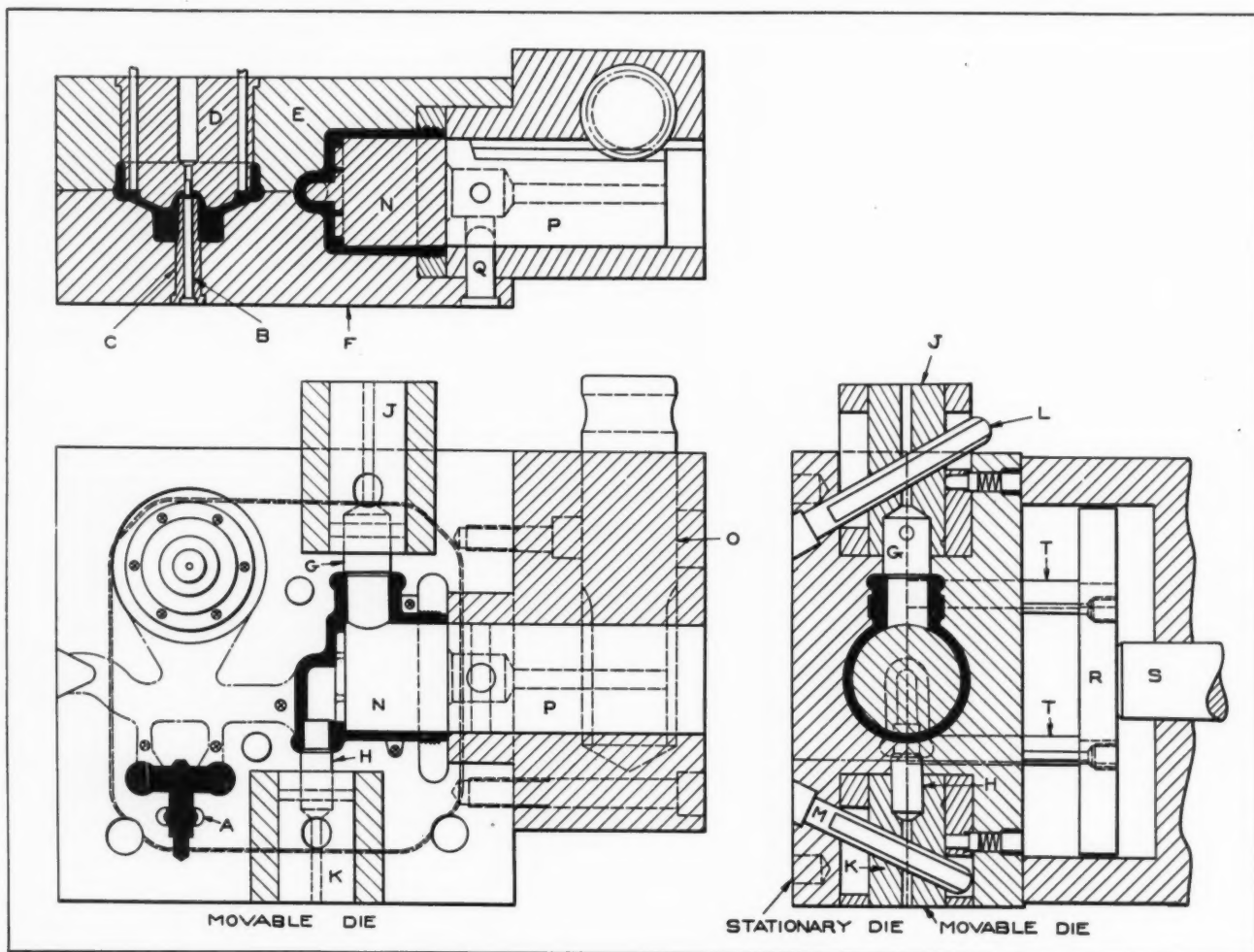


Fig. 8. Details of Construction of Dies Shown in Fig. 6

the stationary die enters a hole in holder *P* when the die is closed, so as to hold core *N*, Fig. 8, firmly as the molten metal is "shot" into the die cavity.

Plate *R* carries eleven ejecting pins, which remove the castings from the movable die when the plate strikes rod *S* during the opening movement. Pins *T* push plate *R* back into the position shown when the movable die is closed against the stationary member. Two "shots" are averaged a minute with these dies, which means a production of 100 an hour of each of the three pieces. These castings are made of zinc. The dies should produce 500,000 parts before they need to be replaced.

Lead battery nuts of the type shown in Fig. 9 are cast with a double-lead square, internal thread $7/8$ inch in diameter. There are $3\frac{1}{2}$ threads per inch. The maximum diameter of the part is $1\frac{5}{8}$

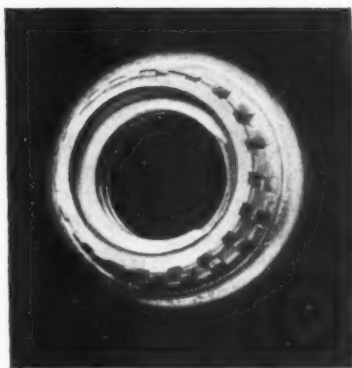


Fig. 9. Lead Battery Nut Die-cast with an Internal Square Thread

inches. The threads are produced so accurately that the nuts are ready for use as they come from the dies. Four nuts are cast at a time with the die set illustrated in Fig. 10. Only one of the die cavities is shown in the left-hand view, which shows the face of the movable

die. However, the center lines of the other three cavities are indicated.

An interesting feature of these dies is that the four externally threaded cores *A* which produce the internal threads in the nuts must be unscrewed from the work-pieces before the movable die can be withdrawn from the stationary die at the end of an operation. The unscrewing of these threaded cores is accomplished by turning a rod on the left-

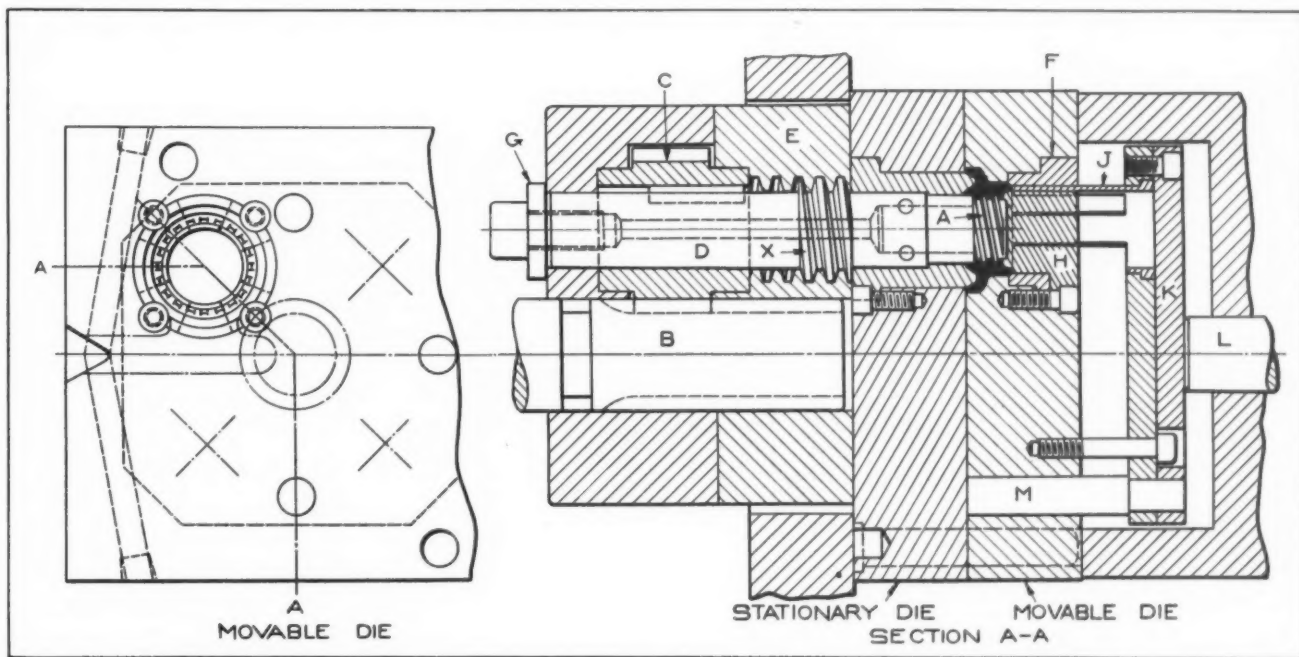


Fig. 10. (Above) Four Shafts *D* with Lead-screws Withdraw the Cores Used in Casting the Threaded Nut Shown in Fig. 9

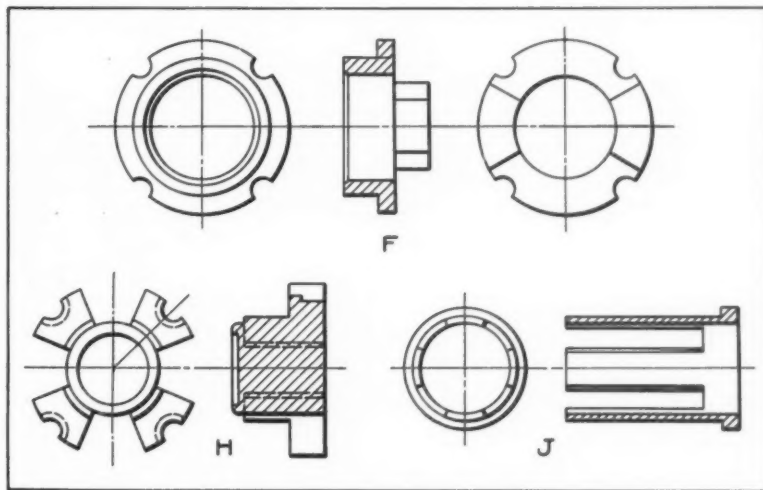


Fig. 11. (Left) Details that Illustrate the Method of Ejecting the Lead Nuts from the Set of Dies Illustrated in Fig. 10

hand end of shaft *B*. This shaft is mounted in the center of the stationary die. When shaft *B* is turned, spur gear teeth on the right-hand end of the shaft revolve four pinions *C*, each one of which is keyed to a shaft *D*. The shank of each threaded core *A* fits into the end of one of these shafts *D* so that the cores revolve with the shafts when pinion-shaft *B* is rotated.

Lead-screw threads are provided on shafts *D*, as indicated at *X*. These threads engage corresponding threads in the die-block *E*. Hence, as each shaft *D* and the corresponding core *A* are revolved, they are also moved laterally to the left, thus withdrawing the core from the work. In positioning the cores prior to the casting operation, shaft *B* is merely turned in

the reverse direction. A washer *G* on the left-hand end of shaft *D* controls the casting position of the threaded core *A*.

Part *F* forms a bevel on the outer end of each nut, while a flanged bushing *H* forms a filleted depression in the same end. Outside of the portion of part *H* that forms this depression, there are four dovetailed slots, as seen in the detailed drawing of this part in Fig. 11. These slots permit fingers on sleeve *J* to come in contact with the work and eject it. Part *F* completely encloses sleeve *J* and bushing *H*. The four ejecting sleeves *J* are operated when plate *K* is

stopped by fixed rod *L* during the withdrawal of the movable die from the stationary member. As the die completes its movement, the

Fig. 12. Details of Dies Shown in Fig. 13, which Cast Lead Terminals on Ends of Insulated Wire Cables

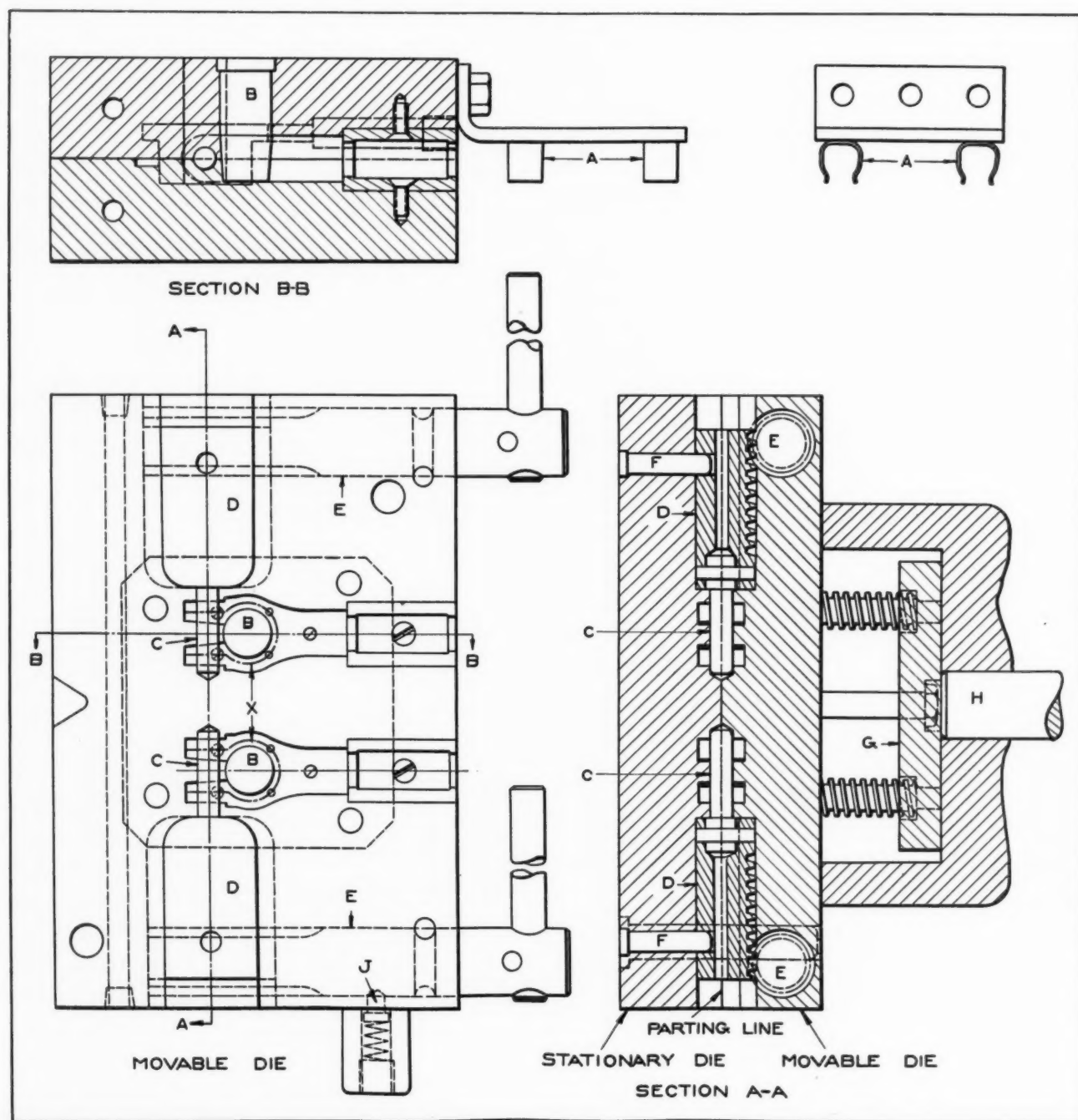


Fig. 13. Dies Designed for Casting Lead Terminals on the Ends of Insulated Wire Cables

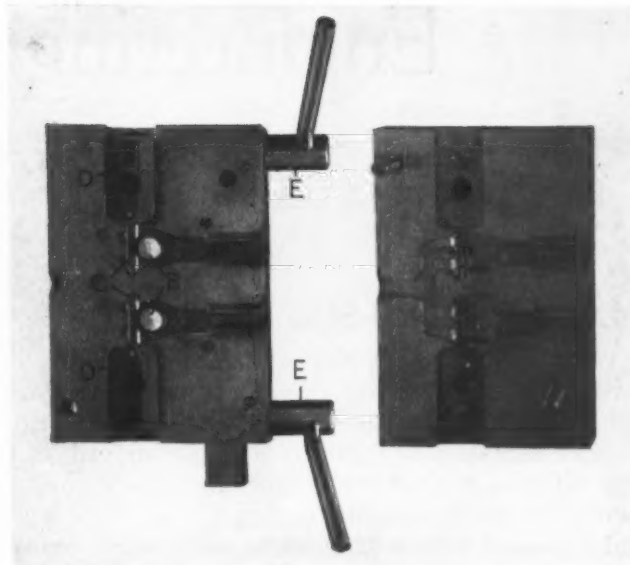
fingers of each sleeve *J* advance in the slots of part *H* and push the casting from the die cavity. Four pins *M* come in contact with the face of the stationary die when the movable die is again closed, and return plate *K* and the ejecting sleeves to the positions shown.

About two "shots" can be made a minute with this set of dies. Based on a fifty-minute hour, this means 400 castings an hour. The melting pot is held at a temperature of about 750 degrees F. Channels are provided across the gate side of both the movable and stationary dies for circulating cooling water.

Lead Terminals Cast on Insulated Wire Cables

The dies illustrated in Figs. 12 and 13 were designed for casting lead terminals on the ends of insulated wire cable. Two cables are inserted in the dies from the right-hand side for each operation. Spring clips *A* on a bracket attached to the movable die member hold the cables in place during the operation.

For reinforcement purposes, steel wires of the shape shown at *X* are cast in the lead terminals. These wires are slipped over the cores *B* of the movable die when it is in the open position, and they are properly seated by cores *C*. Each core *C* is attached to a slide *D*, which has rack teeth on the back, as seen in the right-hand view of Fig. 12. The rack teeth are engaged by the pinion-shafts *E*, which are turned by hand to move cores *C*.



Slides *D* are dovetailed to the face of the movable die. They are locked in the casting position by pins *F* of the stationary die. Spring detent *J* holds the bottom slide from falling from the face of the movable die.

Ejection of the casting is effected by a series of pins on plate *G*, which extend through the die members to the cavities. These ejecting pins are brought into operation when plate *G* strikes rod *H* during the opening movement of the die. Four coil springs surrounding the studs attached to plate *G* force the plates and the ejecting pins into the positions shown when the dies are closed again.

Cores *B* produce holes through the solid portion of the lead terminals. Production on this operation averages one "shot" a minute, or 100 lead terminals per fifty-minute hour. The temperature of the melting pot is maintained at about 750 degrees F.

Cutting Fluids Containing Colloidal Graphite

In a progress report submitted to the American Society of Mechanical Engineers by the sub-committee on cutting fluids, Professor O. W. Boston, chairman of the committee, presents some interesting facts relating to the influence of cutting fluids on cutting speed and tool life, and also refers to the value of colloidal graphite in cutting fluids for turning steel. The paper gives evidence of a very complete study of the subject, and is accompanied by illustrations and charts.

After describing how the experiments were performed for determining the value of cutting fluids of this class, the author states briefly the conclusions as follows: The most promising carrier for colloidal graphite when used as a cutting fluid is oil, preferably plain mineral oil. The best amount of colloidal graphite to use in a plain mineral oil

is 0.153 per cent by weight. The mineral oil, it is stated, becomes, by the addition of colloidal graphite, a most efficient cutting fluid, and the finish produced with a mineral oil containing colloidal graphite was found to be excellent. The increase in tool life was very marked, as well as the increase in allowable cutting speed.

With regard to the selection of cutting fluids, these points are noted in the report: (1) Real economy lies in the selection of that cutting fluid which will do the job with the highest production; (2) cutting fluids cannot be selected on a basis of cost; and (3) the problem of selecting the best cutting fluid must be solved according to the merits of the cutting fluid for the job under consideration, and a record of production is the best means to find the right solution.

Engineering News Flashes

The World Over

14,000-Mile Non-Stop Run

With her Diesel engines running continuously on a voyage from Texas to India, the motorship *Daylight* recently made what is believed to be the world's longest non-stop voyage for a Diesel-driven ship. The oil tanker that made this distance record is owned by the Standard-Vacuum Co. of New York and equipped with a 3200-horsepower Sun-Doxford Diesel engine, and two 120-horsepower Cooper-Bessemer Diesel generator sets. The 14,000-mile voyage to Bombay, where the engines were first stopped, was covered in fifty-one days. Upon examining the engines, only a few minor adjustments were found necessary.

Hydraulic Head of 5800 Feet

According to *Teknisk Tidskrift*, a power station is now being built in Val d'Héremence, one of the side valleys entering the valley of the Rhone in Switzerland, where a total head of water of about 5800 feet is being made use of. The station will generate about 133,000 kilowatts. From a dam erected 6700 feet above sea level, the water is conducted, mainly through a tunnel blasted in solid rock, a distance of 8 miles to the power station, where Pelton wheels are installed coupled to the electric generators.

Airplanes with Automobile Engines

The Bureau of Air Commerce recently placed an experimental order for a two-place airplane powered with a well-known automobile engine, with a view to stimulating private flying through the development of low-priced planes. Referring to this, John H. Geisse, chief of the Development Section of the Bureau said: "Aircraft engines of 90 horsepower cost in the neighborhood of \$1000, due to the small quantity produced. An automobile engine of the same power can be purchased for less than \$150, about the cost of overhauling the aircraft engine. In addition to the reduction in first cost, the automobile engine offers much lower maintenance and replacement cost and also has the advantage of servicing facilities in practically every community.

"The performance of the airplane with the automobile power plant is expected to be comparable to that of airplanes with aircraft engines, except

that the useful load must be less, to compensate for the additional automobile engine weight. However, the weight of this power plant will be no greater than that of the old OX5 engines, which were the backbone of civilian flying after the World War and which were extensively used in training planes during the war; and the reliability should be greater."

Giant Paper-Making Machine

An engineering contract of more than ordinary interest has recently been completed, according to *Industrial Britain*, by Miller & Co., of Edinburgh. The contract consisted of a set of eight calender rolls for a paper-making machine, which, as far as known, will be the largest and widest in the world. The machine will be installed at the Kemsley Paper Mills, Sittingbourne. The rolls are 25 feet 10 inches wide and will produce a sheet of paper 25 feet wide. The capacity of the machine is said to be 1000 tons of finished paper a week. In spite of the length, the rolls were finished with such precision that a light passed behind two rolls lying on top of each other could not be distinguished between them at any point.

Floating Electric Power Plant

The *Normandie*, the new 1029-foot French liner that recently made its maiden voyage, is virtually a floating electric generating plant. The power plant, capable of developing 160,000 horsepower, would be sufficient to propel ten average-sized Atlantic passenger ships. Just what this size power plant means may be best appreciated by the fact that it would be able to produce enough electric current to light and otherwise supply the demand for electricity of the entire city of Boston, a city having a population of about 800,000 people. The principal use to be made of the electricity is obviously for the propulsion of the ship. Four of the largest motors ever built propel the new French liner. These motors are rated at 14,000 horsepower each, giving the ship a total horsepower rating of 160,000, according to the General Electric Co., which organization has acted as consultant in the work. The electric equipment was built by Als-Thom, French associate company of the General Electric Co.

Simple Indicator for Blown Fuses

A tiny neon lamp and casing has been placed on the market by the Littelfuse Laboratories, Chicago, Ill., for the purpose of indicating instantly when and where a fuse is blown. This lamp bulb is the size of a pencil tip, 1 inch long. These little lights are connected in parallel with the fuse and draw no current until the fuse has blown. They can be used in connection with any size of cartridge fuses and plug fuses. They can also be used for indicating open circuits, switches, relays, etc.

Huge Pumps for World's Largest Drydock

One of the problems in constructing the largest drydock in the world, built at Southampton, England, to accommodate the giant ship *Queen Mary*, was the installation of pumps which would empty the drydock in a reasonable length of time. Four great 54-inch pumps, with many parts made of a nickel alloy cast iron, designed to withstand salt-water corrosion and sand abrasion, are used. These pumps, which can be controlled by one operator, will empty the dock in four hours. The dock is 1200 feet long and 135 feet wide at the entrance, and has a capacity of 57,000,000 gallons.

Effect of Tin Compounds on Lubricating Oil

In a publication recently issued by the International Tin Research and Development Council, London, England, it is pointed out, according to *Engineering*, that the deterioration of oils used for engine lubrication can be largely prevented by the use of tin compounds. The deterioration of oils used for this purpose is due mainly to oxidation, which causes the formation of sludge. Tin compounds are effective in inhibiting this sludge formation. The addition to the oil of such compounds as tin oleate or tin tetraphenyl reduces the amount of oxidation and the rise in viscosity, due to prolonged heating.

A British Railbus—a Streamline Lightweight Diesel Car Built by Armstrong Whitworth, which is in Service on the London & Northeastern Railway. The Car has a Seating Capacity for Fifty-seven Passengers and a Baggage Compartment in Addition. It Weighs 17 Tons and can Attain Speeds up to 65 Miles an Hour

Pneumatic Rail Cars Built in England

Railroad cars provided with pneumatic tires of the Michelin type will be constructed in England by the Armstrong Siddeley Motors, Ltd., and will be known as Coventry pneumatic rail cars. These cars have sixteen wheels provided with pneumatic tires and will be driven by twelve-cylinder, 240-horsepower Hispano-Suiza engines. The normal speed of these cars will be about 55 miles an hour, but in test runs, a speed of 70 miles has been attained. When running between 50 and 60 miles an hour, the passengers in the car thought the speed was only 25 to 30 miles an hour. This impression was created largely by the absence of the wheel and rail noise and the freedom from vibration.

Measuring the Aging Rate of Materials

An instrument designed to measure the aging rates of materials, known as the "Oxydator," has been placed on the market by Herman A. Holz, New York. In the case of most materials, aging is due to an oxidizing process. With this instrument, the rate of oxidation of different materials can be determined in advance. It is said that the data for a complete aging curve can be obtained in one hour and forty minutes by the use of this equipment.

Arc-Welded Railroad Cars

Savings of 35 per cent in weight were made possible by the use of arc welding in the construction of fifty-two new streamline, air-conditioned, steel passenger cars of the Chicago, Milwaukee, St. Paul & Pacific Railroad which were built in the Milwaukee shops of that company. The entire body of the cars was built by arc welding with Lincoln equipment. A built-up design consisting of structural shapes, plates, and sheets joined by welding was also the basis of the construction of the underframe.



EDITORIAL COMMENT

More and more, designers of all kinds of industrial products are paying attention to appearance. It is not only in consumer goods—all the way from automobiles to electric flat irons—that this tendency may be observed. The same trend is apparent in industrial machinery.

Appearance and Utility Harmonized in Today's Machine Design

It should not be assumed, however, that appearance is a new factor in machine design. On the contrary, a great deal of attention was paid to appearance in the machinery built seventy-five or a hundred years ago. Architectural designs were once common in steam engines and machine tools; classic styles were applied to water-works' pumps and engines; drilling machines had Corinthian columns; and Gothic moldings served to increase the skill of the patternmaker and molder. Let no one assume that early machine designers were unmindful of appearance. It should not be held against them that they conformed to the taste of their generation and interpreted art as it was then understood.

This earlier phase of decoration and ornamentation in cast iron was succeeded by an era in which practically no attention was paid to appearance. So long as the mechanism functioned, appearance was held to be of no account.

Then came a third era when a new conception of appearance became evident. No longer were forms borrowed from architectural conceptions, but, instead, entirely new artistic values were brought into play. The appearance, as far as possible, was made to harmonize with the purpose of the equipment. One has only to examine any of the well-known makes of machine tools, electric equipment, and household appliances to recognize this. The advance along these lines in the last few years is very marked.

The machine designer has one advantage over the automobile designer in achieving harmony of appearance and purpose. The designer of automobiles is often tempted to go to extremes in order to create something that will appeal to the popular fancy of the moment—something that is new and distinctive. This the machine designer does not have to do. No one expects him to deviate from the conservative lines characteristic of engineer-

ing thought, so long as these lines are pleasing to the eye and the appearance is in harmony with the purpose of the machine.

"Best results in the production of castings, as of any product, can be obtained only by complete understanding and cooperation of everyone concerned, that is, the designer, metallurgist, foundryman, and machine shop superintendent," said a prominent engineer recently before the American Foundrymen's Association. That good castings result from cooperative efforts has always been recognized, but, nevertheless, there is place for still more teamwork in most organizations.

From the viewpoint of the foundryman, the design of the castings should provide for the uniform solidification and shrinkage of the metal in the mold. However, in an effort to limit weight and decrease assembly costs, castings are frequently designed contrary to good foundry practice. This causes expensive foundry losses, and makes the risk of unsound castings greater.

Sound Castings are the Result of Team-Work

Intricate castings involving marked changes in the thickness of different parts are a source of much trouble to the foundryman. The unequal cooling rates cause cracks and shrinkage cavities, and the castings often warp. Careful proportioning of ribs, fillets, flanges, and lugs, and the use of simple cores will do much to aid in producing sound castings and in reducing foundry expense.

Hence, the designer should talk over his problems with the metallurgist and the foundryman, who are likely to make suggestions that will aid in obtaining a better and more satisfactory product. The machine shop superintendent should be consulted, for in many cases he will be able to make suggestions resulting in more easily machined castings and cheaper machining processes. The foundryman who finds it difficult to make satisfactory castings as called for by the drawings and specifications should talk over his problem with the designer. By such cooperative effort, the work of all will be greatly simplified.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers
as Typical Examples Applicable in the Construction of
Automatic Machines and Other Devices

Right- and Left-Hand Thread for Converting Rotary into Reciprocating Motion

By PAUL H. WHITE

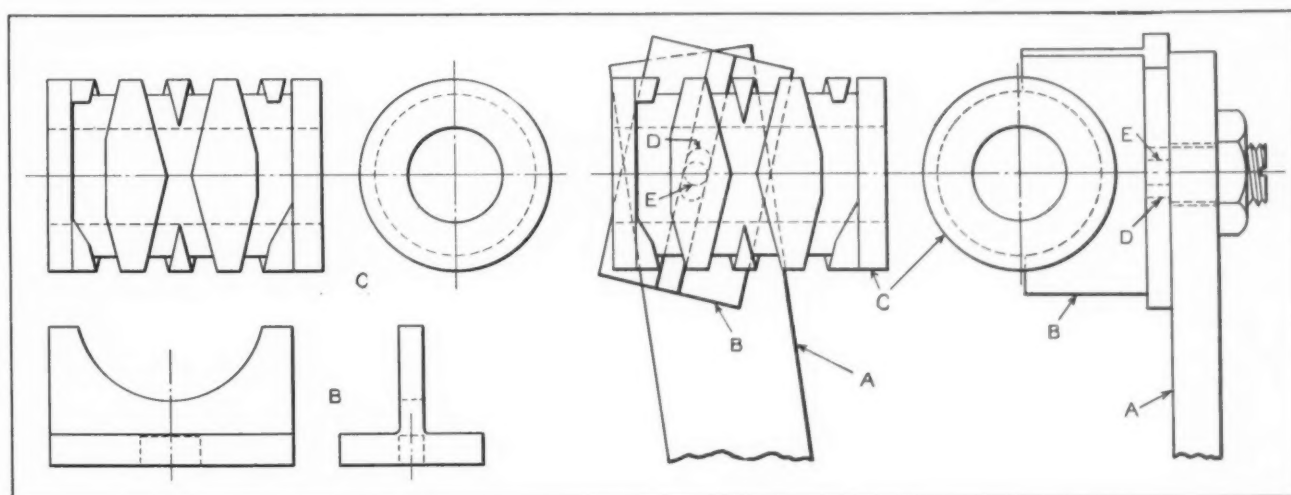
A simple mechanism for converting rotary into reciprocating motion consists of a cylinder having a right- and left-hand thread and a half-nut made as shown in the accompanying illustration. This mechanism was incorporated in a specially constructed printing press for the purpose of imparting an oscillating motion to the rollers which assists in distributing the ink. Obviously, a similar arrangement can be used in numerous other applications, when the speed of rotation is not too high and the load is not too great.

In the application referred to, three oscillating rollers were used for distributing the ink. The two outside rollers were operated by a double rocker arm actuated by the crank-arm *A*, which is fitted with a half-nut *B*. The right- and left-hand threaded cylinder *C* at one end of a rotating shaft serves to oscillate or move the end of arm *A* forward and back. The center ink-distributing roller is moved by a single rocker arm driven by another threaded cylinder similar to the one shown at *C*. The rocker arms are pivoted and carry ball-bearing pins that work against the flanges of spools on the ink-distributing rollers. Thus, as the rocker arms move back and forth, they transmit the required oscillating motions to the ink-distributing rollers.

The half-nut *B* is made from a T-shape, the thickness of the stem being equal to the width of the thread. The stem is formed to a concave shape to fit the contour of the root diameter of the thread, while its over-all length is made somewhat greater than the outside diameter of the thread. Its minimum length must be such as to more than span the gap made by the crossing of the right- and left-hand threads. At the center of the T-shaped bar is an elongated hole *D*, which slides over a pin *E* attached to the crank-arm. Thus, pin *E* causes the crank to rock back and forth with the longitudinal travel of the nut. An elongated hole is necessary for pin *E*, since the arm swings in an arc while the nut travels in a straight line.

When the half-nut approaches the end of its travel in one direction, its axis is on an angle with the center line of the shaft. This angle is equal to the pitch angle of the screw. In order to reverse the travel, the axis of the half-nut must pivot about pin *E* until it is in the proper angular position for the reverse traverse motion imparted by the thread of the opposite hand lead.

The last thread on the cylinder *C* is cut back a sufficient distance to allow the half-nut to pivot, and the "following" edge where the thread runs out at the end is filed back sufficiently to allow the nut to clear this surface and the end flange. The nut is also beveled at the edge where it enters the thread. The threaded cylinder *C* and the half-nut *B* are shown separately in the views to the left.



Cylinder *C* with Right- and Left-hand Threads Designed to Automatically Reverse Direction of Travel of Half-nut *B* at Each End of Stroke Imparted to Crank-arm *A* by the Rotating Cylinder

This mechanism operates smoothly, having a short dwell at each end of the stroke while the nut reverses and picks up the opposite thread. In the printing press application, the two outside rollers are operated by a double rocker arm which causes them to oscillate an equal amount in opposite directions. It is desirable to introduce as much variety as possible into the motion of the three rollers in order to smooth out the ink more effectively. For this reason, the leverage for the crank-arm of the center roller is made somewhat different from that for the outside rollers. In this case, the length of the thread on the cylinder for actuating the crank-arm of the center roller is longer than that which actuates the arms for the outside rollers. With this arrangement, the center roller continuously varies its position in relation to the outer rollers.

Rotary Reversing Mechanism that Constantly Changes its Point of Reversal

By J. E. FENNO

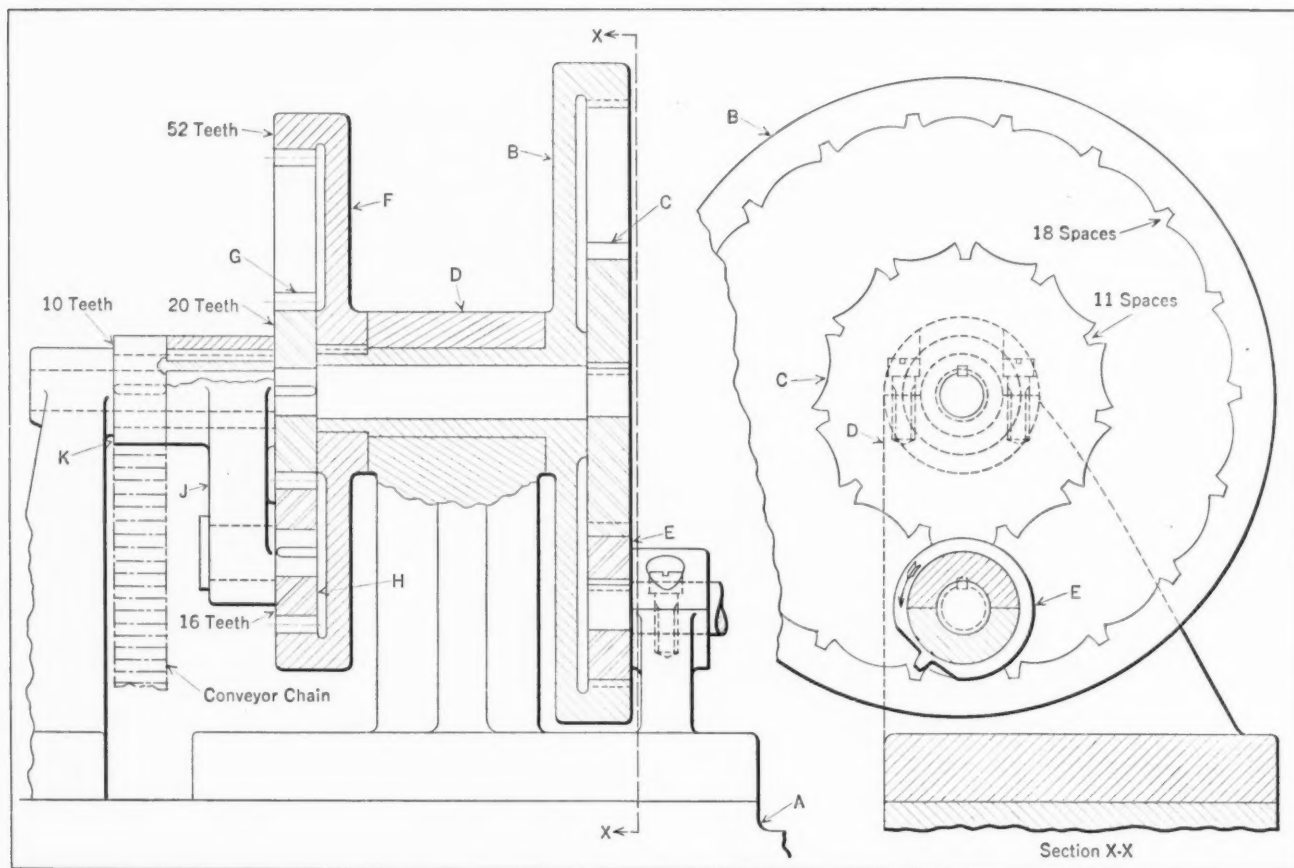
Certain parts of household appliances are coated with enamel by means of a combination dipping and baking machine. The parts are hooked on an endless conveyor chain and passed through a bath of enamel and then through an adjacent heating

oven for drying the coated surfaces quickly. In order to facilitate the spreading of the enamel while the parts are passing through the bath, the chain is given a reciprocating movement. At the same time, the chain advances to deliver the parts to the oven.

This movement of the chain is obtained by the rather ingenious mechanism shown in the accompanying illustration. The mechanism is mounted on the base *A* of the machine. It consists essentially of a combination of planetary gearing and a double intermittent gear arrangement. The intermittent gearing provides the reciprocating movement, while the planetary gearing is necessary to transmit this movement to the chain sprocket.

Beginning with the intermittent gearing, ring gear *B* and center gear *C* are supported in the stationary bearing *D* and mesh with the driving pinion *E*, which rotates in a stationary bearing. At the left-hand end of the sleeve that forms the journal for gear *B* is keyed an ordinary internal ring gear *F*, and on the shaft to which gear *C* is secured is keyed the pinion *G*. Gear *H* is free to turn with the stud in arm *J* and meshes with internal gear *F* and pinion *G*. The arm *J* is keyed to an extension sleeve integral with the conveyor chain sprocket *K*, the sleeve being free to rotate on the center shaft.

When driving gear *E* rotates in the direction indicated by the arrow, the single tooth will engage



Mechanism for Imparting Intermittent, Reversing Drive to Conveyor Chain of Enamel Dipping and Baking Machine

the adjacent tooth space in gear *B* and rotate the latter 1/18 revolution. During this movement, gear *C* will be locked in a stationary position by gear *E*. Hence, the partial rotation of gear *B* will rotate gear *F* and cause gear *H* to roll around the stationary pinion *G* and swing arm *J*, with the sprocket *K*, in the same direction.

Now, as the gear *E* continues to rotate, its cylindrical portion locks gear *B* and the single tooth engages a tooth space in the center gear *C*, rotating the latter 1/11 revolution, after which the cylindrical portion of gear *E* locks it in a stationary position. Rotating gear *C* in this way causes gear *G* to rotate and roll gear *H* on the now stationary gear *F*. In this manner, gear *H* carries arm *J* and sprocket *K* around the center shaft in a direction opposite to that of the driving gear *E*. This completes one cycle of movements.

The required angular movements of the sprocket are as follows: 14 1/2 degrees, or approximately 0.04 revolution, in a clockwise direction, as observed from the right-hand end of the mechanism. The sprocket then dwells and reverses its movement, rotating 9 degrees, or 0.025 revolution. The angular advance of the sprocket for each cycle is $0.04 - 0.025 = 0.015$ revolution, or about 5 1/2 degrees. In calculating the ratios and the number of teeth and tooth spaces in the gears, two separate conditions are involved: First, the sprocket movement when gear *E* rotates gear *B* while gears *C* and *G* are locked; and second, the sprocket movement in the opposite direction when gear *E* rotates gear *C* while gears *B* and *F* are locked.

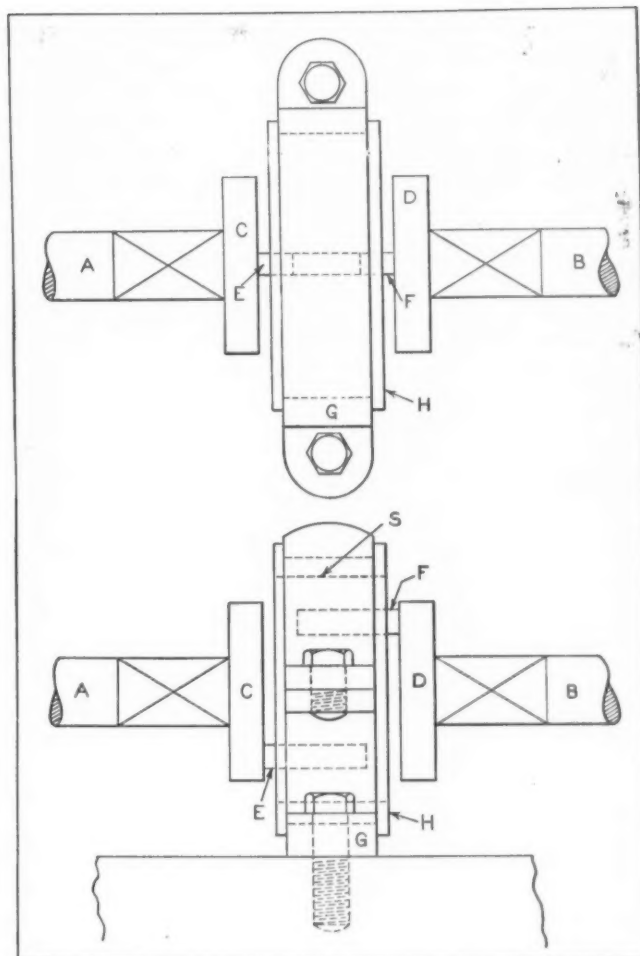
The actual calculation of the gears to give the required drive may be worked out by methods such as described in MACHINERY'S book "Ingenious Mechanisms for Designers and Inventors."

Transforming Uniform Circular Motion into Periodic Variable Motion

By L. KASPER

The accompanying illustration shows a mechanism by means of which a uniform circular motion is transformed into a periodic variable circular motion. The driven shaft *A* and the driving shaft *B* rotate in bearings located on the same axis. Disks *C* and *D* are securely mounted on shafts *A* and *B*. The bearing *G* carries the flanged disk *H*, which is slotted at *S* to receive the pins *E* and *F* in the disks *C* and *D*. The feet of bearing *G* are slotted so that the position of the bearing may be changed in relation to shafts *A* and *B*. The motion of shaft *B* is transmitted to shaft *A* by the pins *E* and *F*, which act in the slot *S* in disk *H*.

In the position shown in the illustration, bearing *G* is so located that the axis of disk *H* coincides with that of shafts *A* and *B*, in which case the motion of shaft *B* is transmitted uniformly to shaft



Mechanism for Accelerating Speed of Driven Shaft During a Portion of Each Revolution

A. If the bearing *G* is moved to one side, the axis of disk *H* is thrown out of alignment with those of shafts *A* and *B*. As disk *H* then revolves in the same plane but on a different axis from shafts *A* and *B*, the pins *E* and *F* will alternately approach and recede from the center of disk *H*, thus imparting a periodically fast and slow motion to disk *C*. The amount of variation in the motion given shaft *A* is controlled by the amount of movement given bearing *G*.

An interesting application of this mechanism was made on a machine on which shaft *A* carried a cam. The speed with which the operating point of the cam passed under the follower was varied by shifting the bearing *G*.

* * *

A new school for welding operators has been opened in Hoboken, N. J., under the supervision of William Bozman, eastern service manager for the Harnischfeger Corporation, Milwaukee, Wis. This school offers a complete course in all types of ferrous and non-ferrous welding and in addition, will render assistance without charge to operators of P. & H.-Hanson welding machines in solving problems.

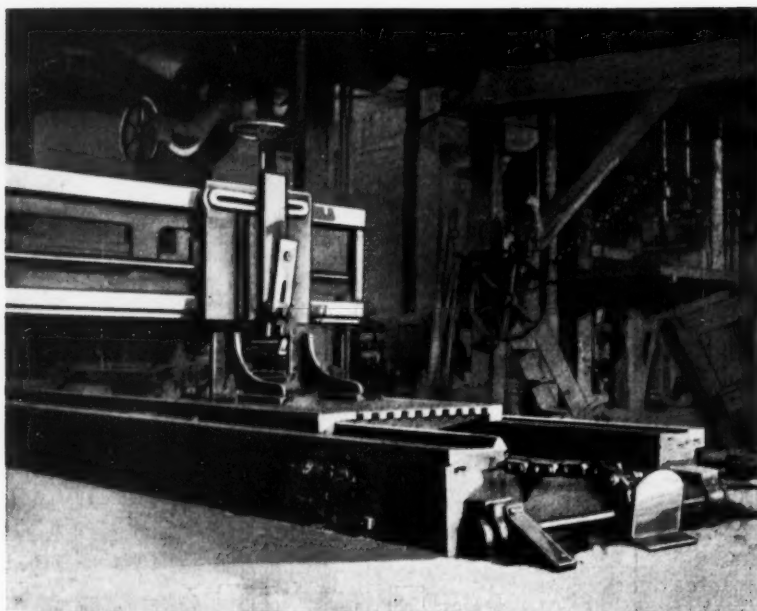


Fig. 1. Planer Having Granite Bed, Cast-iron Ways, and a Chain Transmission—Built in 1836

Some Machine Tools

Historical Notes on
Some Very Old
Machine Tool De-
signs and Types of
Machines Embod-
ing Odd Features
of Construction

TO contrast the past with the present has always had a fascination for the engineer. This article, in which some early machine tools are passed in review, gives the reader a chance to make comparisons between the early efforts and the present achievements of the builders of the master tools of industry. Much interest is attached to some of these old machines, because many of them embody principles that are still applied, in more highly developed forms, in present-day machine tool construction.

From these historical notes, it becomes evident that the development into more perfected forms of designs has gone on continuously, and a similar development is even now in process. The achievements of nearly a century ago are now history; but at that time, they were indications of trends that contemporary engineers found it necessary to study thoroughly. In the same way, the achievements of today will have only historical interest tomorrow; but the engineer of today must be thoroughly informed on what is going on, if the steady progress is not to leave him behind. Hence, great expositions like the one to be staged in Cleveland next month and the descriptions of the machines to be exhibited, as they will appear in coming numbers of *MACHINERY*, have an educational, as well as a commercial aspect.

These historical notes have been gleaned largely from early volumes of *MACHINERY*. The object is simply to present briefly a few outstanding facts about some exceptional pioneer machine tools. No attempt has been made to record even an outline of the history of machine tool developments, as that would fill a large volume. At best, it would be incomplete, due to the lack of authentic records.

Lathe Having Wooden Frame and Cast-Iron Ways—Built in 1830

In 1820, Nathaniel Wiley built the first machine shop in Watertown, N. Y., and in 1830 a lathe was built having cast-iron shears or ways bolted to a wooden frame. A rack feed was used for the carriage instead of a chain feed, as on certain earlier designs. This rack, being movable, was clamped to the carriage in a position depending upon the length of the part to be turned. The lathe had a swing of 22 inches and a capacity of 10 feet between centers. It remained in use in this and other shops fifty-nine years, or until 1889.

Another Lathe Having Wooden Bed and Iron Ways—Built Just One Hundred Years Ago

Another lathe, built five years after the one just described, also had a wooden frame with iron ways or bearing surfaces for the carriage. This is be-

Next month machine tool users will have an opportunity to see the most complete array of modern machine tools ever assembled in this country under one roof. The Machine Tool Exposition that will be staged in a few weeks will be one of the great events in the history of the machine tool industry and of the machinery industry as a whole. To contrast the highly developed machines of today with some of the earlier types of machine

of the Past Century

Even a Casual Examination of these Early Machines Offers Striking Evidence of Revolutionary Changes in Machine Design

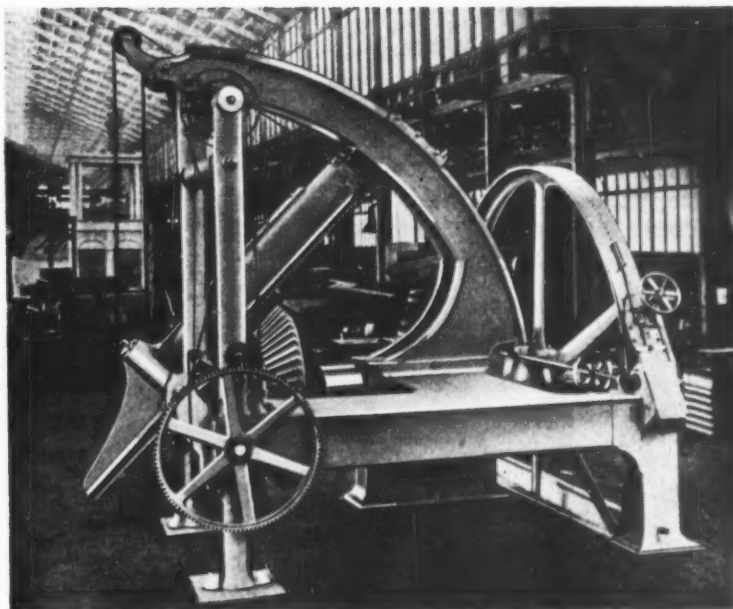


Fig. 2. Corliss Bevel Gear Planer, Exhibited at the Centennial Exposition, Philadelphia, 1876

lieved to be the first Putnam lathe, built by J. & S. W. Putnam in 1835. This firm, founded by the two Putnam brothers, had a shop at Ashburnham, Mass., at the time this lathe was built. The business, however, was transferred to Fitchburg in 1838, and the name changed later to the Putnam Machine Co.

This first Putnam lathe is illustrated in Fig. 4. It had one belt speed, and the back-gears were disengaged by sliding along the shaft instead of employing an eccentric motion. A rack was used to push and pull the carriage along the bed, the direction depending upon the engagement of one of two worms with the worm-wheel. The position of the worm-wheel was controlled by the lever and rod seen below the lathe bed. When this lever was in the intermediate position, the worm-wheel was in between the two worms, leaving the carriage free to be operated by the handwheel at the right. The carriage had a cross-feed screw and stop, and was

elevated at the back by a screw bearing directly on the way.

Lathe Built in 1833 Having Cast-Iron Frame, Cone Pulley, and Back-Gearing

Baxter D. Whitney, a veteran tool builder of Winchendon, Mass., designed and built, in 1833, a lathe possessing unusual features, considering the date of its construction. The frame was of cast iron, except that two wooden beams extended between the legs as a reinforcement. The headstock had a four-step cone pulley and back-gearing, with the back-gear shaft located directly beneath the spindle.

The feed mechanism consisted of a belt drive from the main spindle to worm-gearing consisting of two parallel worms and a large worm-wheel. Either of these worms could be swung into engagement for changing the direction of feed; the neutral position provided for feeding by hand. Motion was transmitted from the worm-wheel through a pinion engaging a rack which extended along the bed on the inside and was attached to the carriage. A rod along the front side of the bed, provided with ball-shaped handles, gave the operator control of the feeding mechanism from the working position.

Granite Bed and Chain Transmission for Carriage of 48-Inch Lathe—1836

The Silver & Gay Co. was a pioneer among American machine tool builders. Two brothers, Ira and Zeba Gay, started a machine shop in Nashua, N. H., well over a century ago. Later, Harvey Silver of Hillsboro, N. H., became associated with the business, which, in 1835, was named

tools may, therefore, prove of timely interest; and to make such a comparison possible, this article has been prepared, briefly describing a few very early types of machine tools.

Those who attend the great exhibition of shop equipment that will be held in Cleveland September 11 to 21 will be impressed by the striking contrasts between the latest developments and the more primitive machines here illustrated.

Gay, Silver & Co. The name was subsequently changed to Silver & Gay, and in 1884 to Silver & Gay Co. The construction of machine tools in this historical old shop was discontinued when the business was taken over by the North Chelmsford Machine & Supply Co. over forty years ago.

The shop of Silver & Gay Co. had a lathe with a granite bed and "chain transmission." The latter was located inside of the bed and used for feeding the carriage along the ways, a feature common to other early lathes. This machine is believed to have been built about 1836. It had a swing of 48 inches and a power cross-feed, in addition to the longitudinal feed.

When the Silver & Gay shop adopted the screw feed, it was placed "inside of the bed out of the way of chips and where it takes most of the work, since it is nearly under the cutting tool." The carriage feed-rack was also placed inside of the bed for the same reasons, and it was used for moving the carriage when not cutting screws, as in modern designs.

Application of Lathe Carriage Feed Control—About 1860

A lathe built about 1860 by Gage, Warner & Whitney, of Nashua, N. H., was provided with a handle on the carriage for disengaging or reversing the feed. This handle controlled a clutch located between the forward and reverse gears, which were incorporated in the headstock. This carriage feed control was a widely advertised feature, but the description of it published in November, 1896, *MACHINERY* does not mention whether it was original with Gage, Warner & Whitney lathes.

Some of the Early Turret Lathes—1845 and 1860

The invention of a turret for readily and accurately presenting different tools in successive order seems to have been the work of more than one man. The vertical turret has often been credited to Henry D. Stone. The turret principle, however, was not originated by Mr. Stone, as it had been utilized previously by several other inventors, including F. W. Howe and E. K. Root.

One of the earliest turret lathes, if not the

earliest, was built in 1845 by Stephen Fitch at Middlefield, Conn. The turret of this machine revolved about a horizontal axis and had eight tool positions. A machine built by E. K. Root at the Colt Armory about 1855, known as a chucking lathe, had a horizontal turret. Another early design by Mr. Root had a vertical turret and a stop-screw for the slide, but no automatic tripping device. The movements of the turret of the slide were controlled by a lever at the front of the bed opposite the headstock. The first commercial turret lathe, however, seems to have been built by Robbins & Lawrence of Windsor, Vt., in 1854.

A turret lathe in the shop of Silver & Gay Co., which probably was constructed about 1860, had some interesting features. The turret was in the form of a six-arm rimless pulley or spider. The arms were rectangular in shape and had tool holes at the end with set-screws for holding the cutters. The indexing pin passed through the turret and into the slide. This pin, having a tapering point, was operated by a small handwheel. A cutting-off slide was located close to the chuck, and this could be moved along the bed.

The flat turret lathe was invented by James Hartness in 1889, while he was superintendent of the Jones & Lamson Machine Co. The first number of *MACHINERY* (published in September, 1894) contains an advertisement of the flat turret lathe. Mr. Hartness, in an article published in December, 1894, *MACHINERY*, explains that "turn-table turret lathe" was the original name and that the term "flat turret lathe," later adopted by him, was applied to the machine by its users. It soon became the regular trade name for this type of machine, and has been used to designate it ever since.

Cam-Controlled "Automatic Turret Lathe"

A great field was opened in machine tool development by the invention of the "automatic turret lathe" for making screws and similar parts, by Christopher N. Spencer, who was then connected with the Billings & Spencer Co., Hartford, Conn. The idea of designing an automatic turret lathe or screw machine was suggested to Spencer by another machine which he had invented for turning spools for sewing machines. The action of this automatic turret lathe was controlled by a cam cylinder provided with flat strips, adjustable according to the movements re-

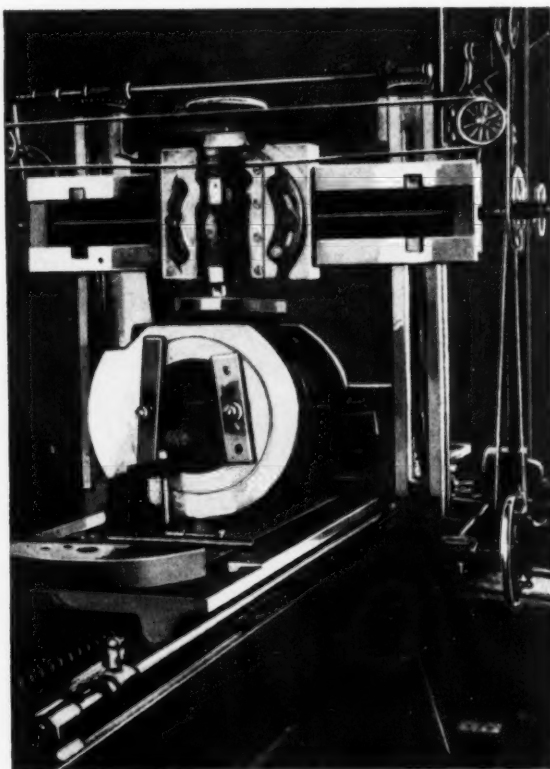


Fig. 3. Screw-driven Planer Equipped with Reversing Toolholder for Cutting in Both Directions—Built in 1839

quired, but this exceedingly important feature was overlooked by the patent attorney. This machine proved so successful for making screws automatically that Spencer severed active relations with Billings & Spencer Co. in 1874 and soon afterward established, with others, the Hartford Machine Screw Co.

Planer Having Granite Bed and Chain Transmission

It is believed that the first planer in America was built in 1836 in the shop of Silver & Gay Co., North Chelmsford, Mass., although a planer is said to have been built at about the same time by Pedrick & Ayer of Philadelphia. An early design of Silver & Gay planer (Fig. 1) had a bed of granite, resting on a solid foundation and dressed smoothly to receive the cast-iron ways for the table. These ways and the corresponding surfaces on the table were finished by chipping and filing. There was a V-shaped way on one side for a guide and a flat way on the other side. A flat-link chain and sprocket type of drive was used. The chain passed around an idler sprocket at one end and a driving sprocket at the other. This driving sprocket was driven by gearing and a belt transmission from an overhead shaft. An automatic reverse, controllable by hand from any position on one side of the planer, was provided, as well as an automatic trip for lifting the tool out of the cut on the return stroke.

Reversing Screw Drive Applied to Planer

Some of the very early planer designs were equipped with a screw for traversing the table along the bed. This screw transmission should not be confused with the well-known Sellers drive (consisting of a worm and rack), as a driving screw was located beneath the table and parallel to it. Provision was made for reversing the screw to obtain the forward and backward movements of the table.

One arrangement for obtaining this reversal consisted of a double bevel gear drive at the end of the screw. By shifting a belt from one pulley to another, the two pinions were alternately revolved, thus reversing the rotation. The two sets of bevel gears were of different ratios, to provide a rapid reverse. The age of this planer is not known, but it was found in 1896 in the shop of Gage, Warner & Whitney, Nashua, N. H., and was then ancient.

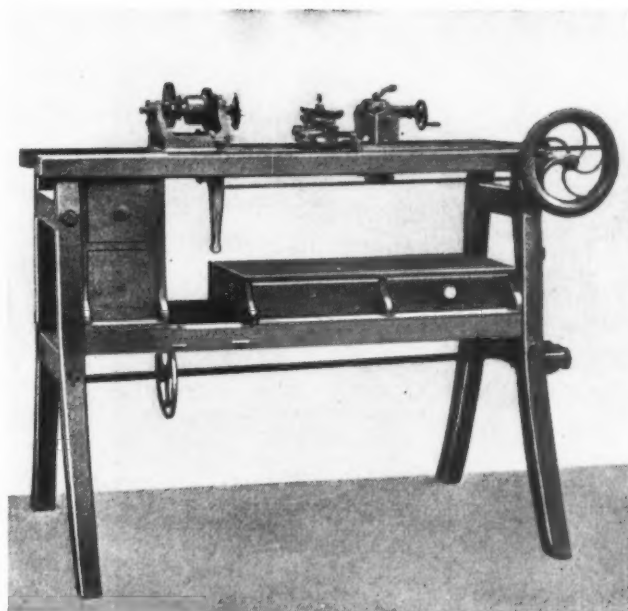


Fig. 4. The First Putnam Lathe, Built by J. & S. W. Putnam in 1835

Screw-Driven Planer with Reversing Tool-Holder—Built 1839

A screw-driven planer, built in 1839, was equipped with a tool-holder that reversed the tool at each end of the stroke to permit cutting during both forward and backward movements of the planer table (see Fig. 3). This reversing action of the tool-holder was ob-

tained by means of ropes connected with the feed mechanism, and was said to operate satisfactorily when the ropes were in good condition. If they were not in good condition, which seems to have been quite often, a boy was given the task of keeping the tool turning in the right direction. This planer, doubtless of English design, was owned in 1897 by Messrs. J. Simpson & Co., Ltd., of London. This reversing style of tool-holder was known as the "Jim Crow."

Rack and Spur Gear Drive Applied to Planer

The firm of Slate & Brown, Windsor Locks, Conn., was one of the first regular builders of planers in the United States. One of the planers built by this firm during the forties was illustrated in August, 1896, *MACHINERY*, page 365. The driving mechanism of this early design is an important feature, as the table was reciprocated by a large spur gear or "bull wheel" meshing with a rack on the under side, as in modern designs. This bull wheel was revolved through reduction gearing by belt-driven pulleys provided with a shifting device for obtaining reversal of motion.

The Earliest Types of Milling Machines—1818 and Later

It seems to be quite well established that the first milling machine for plain milling built in this country was made in the gun shop of Eli Whitney at Whitneyville, Conn., in 1818. This machine, still in existence, is a small bench type. A solid wooden block forms the base of the Whitney milling machine, and the supporting legs are made of wrought iron. The main spindle is driven directly by a belt pulley, and between the two main spindle bearings there is a double-grooved wooden pulley connecting with a smaller pulley on a worm-gear shaft of the feed mechanism. The worm of this shaft engages

Fig. 5. An Automatic Gear-cutting Machine Built Prior to 1860

a worm-wheel mounted on the table feed-screw. The worm is held in engagement by a spring latch which permits disengagement for hand-feeding. The worm-shaft is pivoted at one end to allow the worm to drop out of engagement readily.

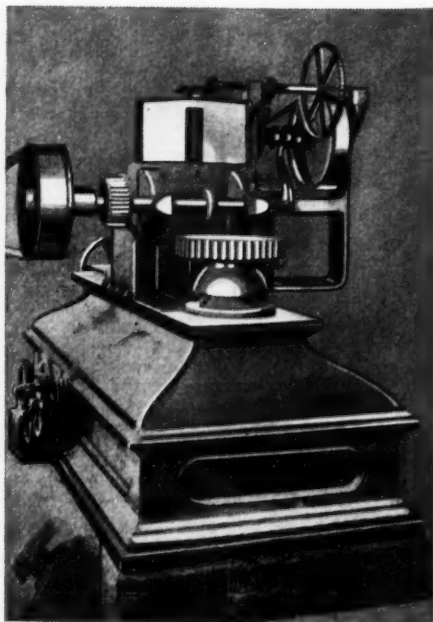
A milling machine built by the Silver & Gay Co. prior to 1841 consisted of a horizontal work-table and a vertically adjustable cutter-slide, with a horizontal cutter-spindle driven through spur gears by a pulley and belt transmission. This design of machine was equipped with a simple form of indexing work-holder.

A "slabbing" type of milling machine, which may at least be classed as a pioneer of this type, was shown in April, 1896, *MACHINERY*, page 229. This machine was constructed probably about 1840. It had a wooden base, and the bed or table moved along iron ways. The entire saddle, including the cutter-spindle and its driving mechanism, could be raised or lowered on vertical posts by screws and bevel gears. A flywheel pulley drove the cutter through a pinion meshing with a gear on the cutter-spindle.

Milling Machines of Knee Type Built in the Late Fifties

The column and knee type of construction for milling machines evidently was introduced in the late fifties. A machine of this design was built by Smith & Coventry of Manchester, England, in 1860, and Collyer, also of Manchester, built similar designs at about the same time. The Smith & Coventry machine, which was illustrated in April, 1896, *MACHINERY*, page 229, had an overhanging arm and outboard arbor support similar to modern designs. The writer of the article in the April, 1896, number of *MACHINERY*, F. W. Howe, states that he was informed by Lucien Sharpe that the first Brown & Sharpe milling machine was of the knee type. This machine is now in the possession of the Brown & Sharpe Mfg. Co.

The universal milling machine was invented by Joseph R. Brown in 1861. This should not be confused with the so-called "universal miller" designed by Frederick W. Howe



in 1852. The latter machine had certain universal adjustments, such as a chuck that could be indexed and inclined in two planes and a vertically adjustable cutter-slide. The machine designed by Mr. Brown was a universal type according to present-day usage of the term, and it was designed for such operations as helical milling, gear-cutting, and various jobs requiring either indexing or a combined rotary and axial motion. The first universal machine made by the firm, then known as J. R. Brown & Sharpe, was sold to the Providence Tool Co. in 1862, and was used in making special tools for the manufacture of United States Government rifles.

The well-known Lincoln type of milling machine is named after George S. Lincoln, of the firm then known as George S. Lincoln & Co., Hartford, Conn. Mr. Lincoln, however, did not originate this type, but he introduced an improved design. Milling machines constructed along the same general lines had previously been built by the Phoenix Iron Works of Hartford, Conn., and also by Robbins & Lawrence Co., of Windsor, Vt.

Vertical and Horizontal Boring Mills—Built in 1840

The boring mill is another pioneer machine tool from the shop of Silver & Gay. Considering the date of its construction—1840—this 16-foot boring mill embodied remarkable features. It was equipped with three heads, all having power feeds in both directions. The center head was arranged to operate as a slotter. Thus, after a pulley rim had been turned by using the two outer heads simultaneously, the center head was used first for boring the hub and then for slotting the keyway. The table of the machine was revolved by a pinion meshing with teeth on the periphery of the table, and the outer edge of the table was supported by means of rollers.

A horizontal boring mill built about 1840 consisted of a horizontal spindle or bar carried by a slide having vertical adjustment on uprights which extended to the ceiling to secure rigid support. The

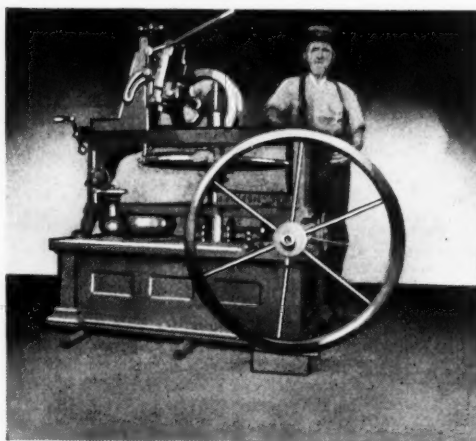


Fig. 6. Early Design of Combination Spur- and Bevel-gear Cutter and the Man who Wore it Out

vertical movement of the slide was obtained through a rack and pinion transmission. A counterweight was provided for this slide or head, and provision was made for feeding the spindle either by hand or power. The work-holding member consisted of a car mounted on tracks located at right angles to the boring-bar. This car, which could be moved some distance for loading or unloading, suggests the modern type of rolling jig or fixture used in some of the automotive shops.

Earliest Gear-Cutting Machines on Record

One of the pioneer machine shops of New England was that of Gage, Warner & Whitney, of Nashua, N. H., which was referred to previously in connection with a carriage feed control for lathes. A gear-cutting machine (Fig. 5) built in this shop prior to 1860 (exact date not known) is interesting in that it was entirely automatic, so far as cutting one gear is concerned.

This machine was a vertical cutting type, there being a vertical slide and work-spindle. The cutter-spindle was driven from a belt pulley through spur gears. The reversal of the cutter-slide feed-screw for upward and downward movements was controlled by a clutch which, in turn, was thrown from one position to the other by a weighted arm connecting with a segment gear. When this weight passed the central position, it dropped to the other side, thus quickly shifting the clutch.

A gear-cutting machine designed along fairly modern lines and arranged for cutting either spur or bevel gears by means of a form cutter (not formed or form relieved to permit grinding the tooth faces without changing the shape) was built in 1841. This machine was a vertical cutting type and was so designed that the cutter-slide could be inclined relative to the work-table for bevel gears.

Combination Type of Gear-Cutter with Index-Plate Having 15,690 Holes—Built in 1852

Another combination type of gear-cutter designed along the general lines of the one just described was built in 1852 by the Putnam Machine Co., Fitchburg, Mass. (see Fig. 6). This machine, like the preceding design, had a vertical work-arbor with a large indexing plate below the work-table. It was also a vertical cutting type, and provision was made for inclining the cutter-slide (which was hinged to the main slide at the lower end) for cutting bevel gears. This machine had a fairly heavy flywheel on the cutter-arbor to steady the movement. The large index-plate is an interesting feature, as it contains fifty-two rows of holes, with a total of 15,690 holes.

Bevel Gear Planer of Templet Type—1855

In the fifties, probably in 1855, a templet type of bevel gear planer was built by Silver & Gay. This was framed of heavy timber and the wearing sur-

faces were protected by iron. The gear blank was held by a horizontal timber, mounted on trunnions so that it could be bolted in an angular position corresponding to the inclination of the gear. The tool-slide was traversed along its supporting beam, while the latter was guided at its outer end by the templet or former. This former, owing to its distant position, was made to an enlarged scale, so that any errors would be correspondingly reduced on the tooth profile.

The tool-block was of the reversible type, the tool making a half revolution at each end of the stroke so as to cut in both directions. The early mechanics evidently considered this feature very important, as noted elsewhere in connection with planer design. Gay, Silver & Co. (the older name of the firm) was awarded a gold medal for this bevel gear planer by the Middlesex Mechanics' Association.

Another Early Bevel Gear Planer of Templet Type

According to an article on cutting bevel gears, published in June, 1898, *MACHINERY*, the first bevel gear planer of the templet or copying type to obtain any great degree of prominence in the United States was built by George H. Corliss, of the Corliss Steam Engine Co., Providence, R. I. This machine (Fig. 2) was exhibited at the Centennial Exposition in Philadelphia in 1876.

As the illustration indicates, it was designed for cutting large gears. The cutter-slide had a reciprocating movement along the guide bar. The guide bar was pivoted at the lower end to permit movement in any direction necessary to follow a tooth contour. The templet controlling the action of the guide bar and tool was located at the upper end of the bar and was large in proportion to the tooth profile. The cutter-slide was driven by shifting belts similar to a planer, and there was provision for relieving the tool to prevent dragging on the return stroke. The large dividing or indexing wheel at the rear of the machine is of interest.

With the development of bevel-gear cutting machinery, both of the templet-planer and the molding-generating type, the two names William Gleason and Hugo Bilgram are prominently identified. It was in 1876 that William Gleason, the founder of the business now known as the Gleason Works, Rochester, N. Y., patented his first bevel gear templet type planer. In 1883, Hugo Bilgram, of the Bilgram Machine Works, Philadelphia, Pa., built his first bevel gear generator.

The September, 1895, number of *MACHINERY* contains "the first published illustration of an automatic bevel gear planer, on which foreign and American patents were issued to the Gleason Tool Co., Rochester, N. Y., in April, 1894." This bevel gear planer is of the templet type, a former being used to guide the cutting tool and give the gear tooth the proper profile. The gear was indexed automatically and the machine was said to require "no more skill to operate than a rotary gear-cutter."

Charts for Calculating Worm-Gear Loads

*With an Introduction
by Professor Earle
Buckingham of Mass-
achusetts Institute of
Technology*

By JOHN H. WILL

With all types of gears, there are three limiting factors to the loads that may be applied safely. These are:

First: Beam strength of the teeth. The loads must be such that the teeth will not break.

Second: Surface endurance limits of the materials. The working loads must not introduce stresses that exceed the surface endurance limits of the materials; otherwise, excessive wear will take place.

Third: Heat generated in operation. The frictional heat of operation must not be too great; otherwise, the oil film will break and rapid abrasive wear and seizing may result.

Reliable data on the load capacities of worm drives are scarce. The analysis of the contact conditions on worm drives is quite complex. The position of the pitch plane of the worm in relation to the thread of the worm has a pronounced influence on the nature of the contact, particularly with the higher lead angles; this contact, in turn, has a pronounced influence on the intensity of the compressive stresses set up by the load.

In general, the load capacity of slow-speed (under 600 R.P.M.) worm drives is limited largely by the beam strength of the teeth. The load capacity of intermediate-

speed (from about 600 R.P.M. to 1000 R.P.M.) worm drives is often limited by the surface endurance limits of the materials. The load capacity of the higher speed worm drives is generally limited by the heat of operation.

The beam strength of the gear tooth is affected by the circular pitch, the thread angle of the worm, the number of teeth in the gear, and the width of face of the gear. The compressive stresses set up between the worm and gear are affected by the diameter of the gear, the thread angle of the worm, the position of the pitch plane of the worm, the helix, and the width of face of the gear. The heat of operation is affected primarily by the load, the speed of the worm, and the extent of the exposed area of the gear-case.

This brief summary gives an idea of the difficulty in establishing simple rules and equations for determining the load-carrying capacity of worm drives.

The values given by Mr. Will in the accompanying charts appear to be based on the surface endurance limits of the materials and also appear to be safely conservative for both surface endurance and heat of operation.

EARLE BUCKINGHAM

ONE method of determining the maximum safe tangential load at the pitch line of the worm is by using the following formula:

$$W = k_1 b p$$

in which W = maximum safe tangential load, in pounds, on worm-gear teeth at the pitch line; b = width of worm-gear tooth, in inches; p = circular pitch, in inches; and k_1 = constant determined from the accompanying diagrams.

The value of b is either taken as the actual width of the worm-gear tooth, or it is taken to be "equal to that chord of the outside circumference of the worm which is tangent to the pitch diameter of the worm, plus one-fourth of the circular pitch, if the worm-gear face is equal to or greater than this dimension." This rule will be made clearer by reference to Fig. 1.

The value of constant k_1 depends on the peripheral velocity of the worm, number of teeth in worm-gear, the character of the ser-

vice, the strength of the gear tooth, the contact pressure, and the design of the worm-gear unit. The accompanying charts give values of constant k_1 for worm-gears operating under severe operating conditions, enclosed in a dustproof casing with ample oil chamber and heat radiating surface, using a high-grade steel worm and a phosphor-bronze worm-wheel with a high-grade lubricant. The values of constant k_1 are given, as indicated, for 14 1/2-, 20-, and 30-degree involute teeth.

These charts are based upon long practical experience. The values of k_1 should not be exceeded if successful operation is expected. In several cases where worm-gears have failed, the values of k_1 were found to be from 90 to 100 per cent greater than given by these charts.

As an example of the use of the charts for a specific case, assume that we wish to find the safe tangential load for a 60-tooth worm-gear, 0.7854 inch circular pitch, 2-inch face, 3-inch pitch diameter of worm, 14 1/2-degree pressure angle, and a peripheral velocity of 710 feet per minute.

To solve this problem, proceed

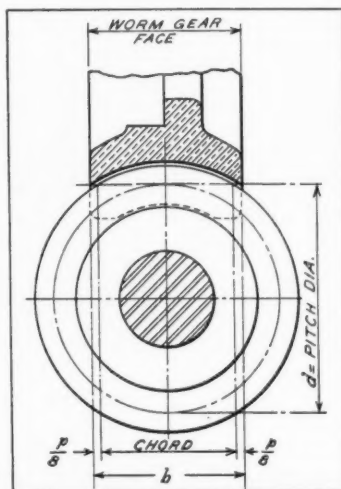
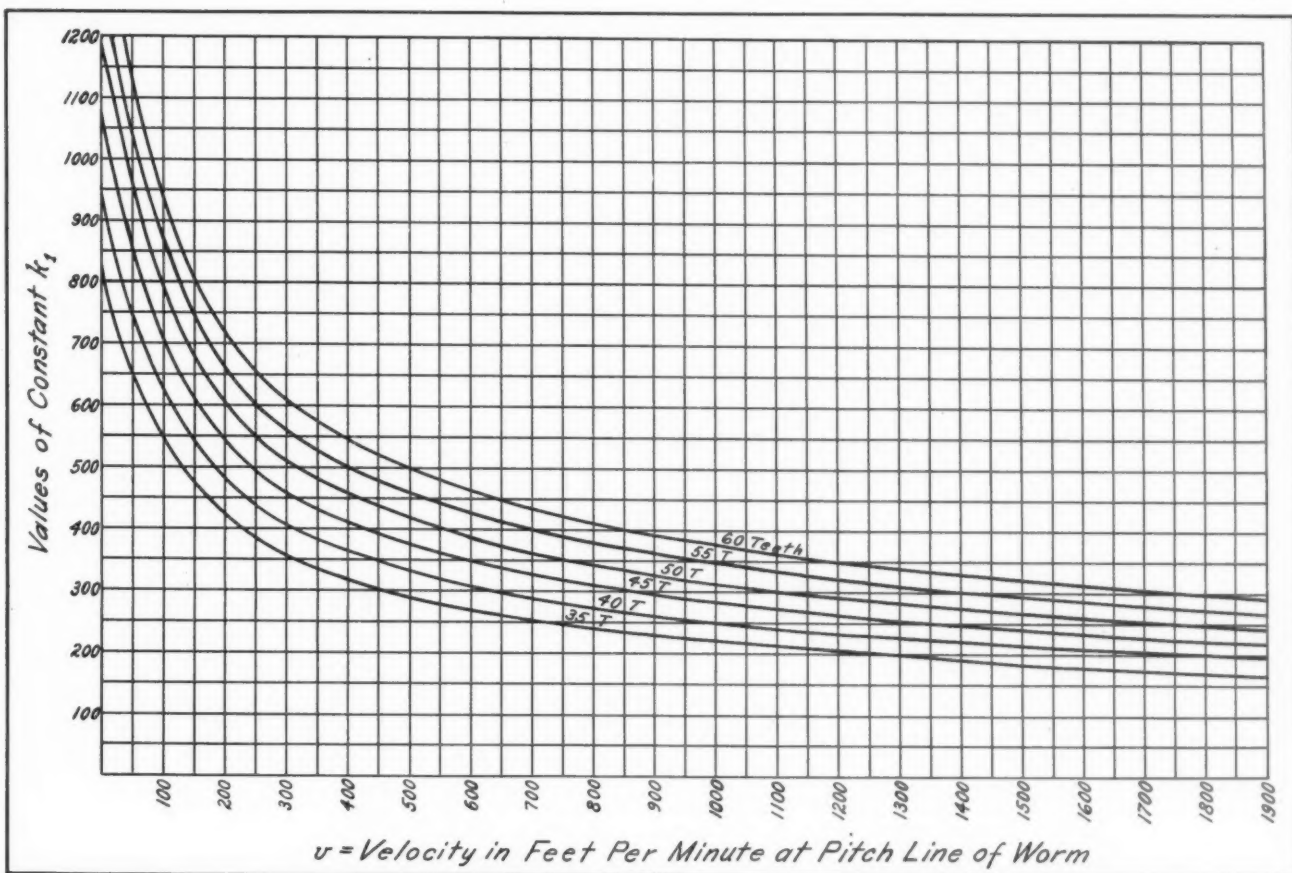
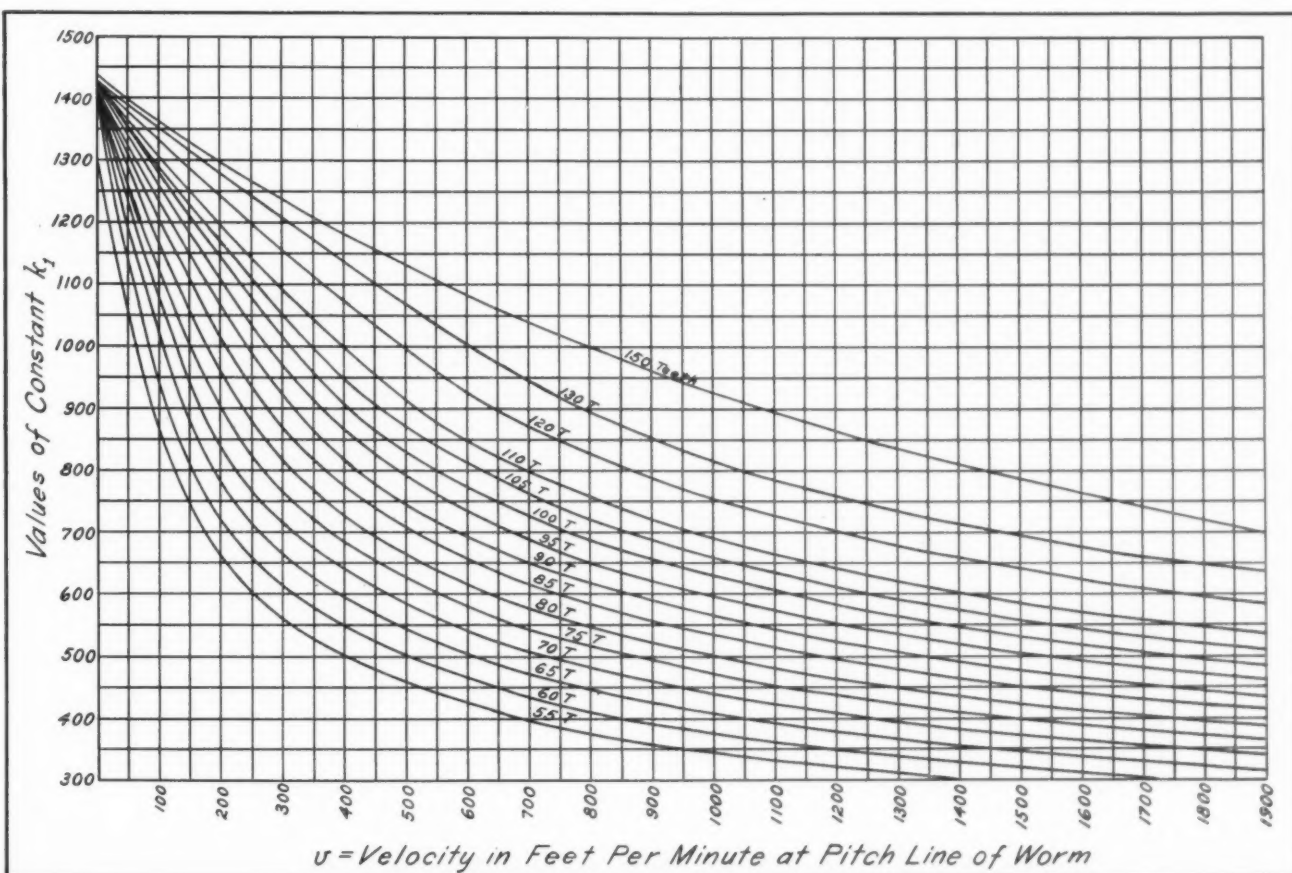
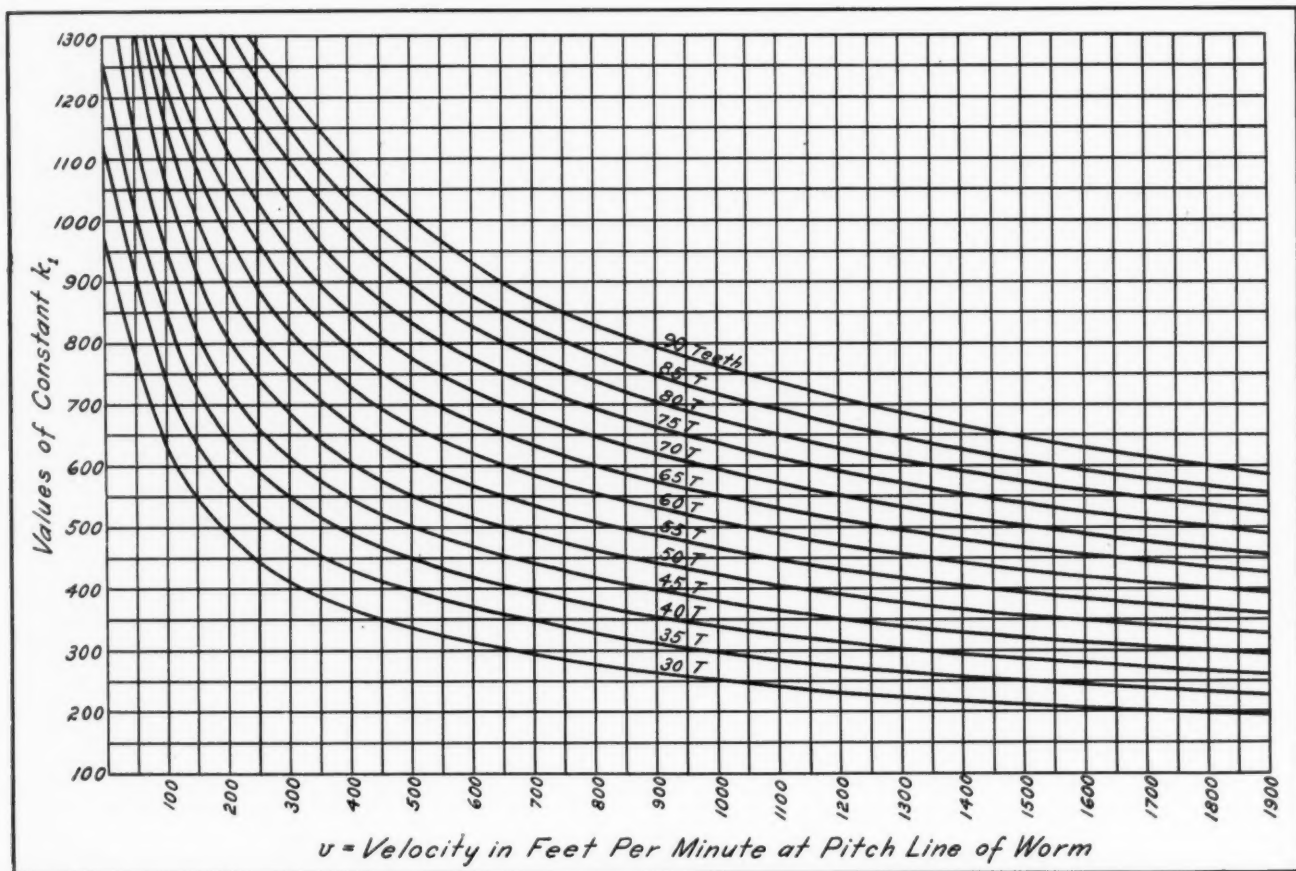


Fig. 1. Illustration Showing how Value of b is Obtained

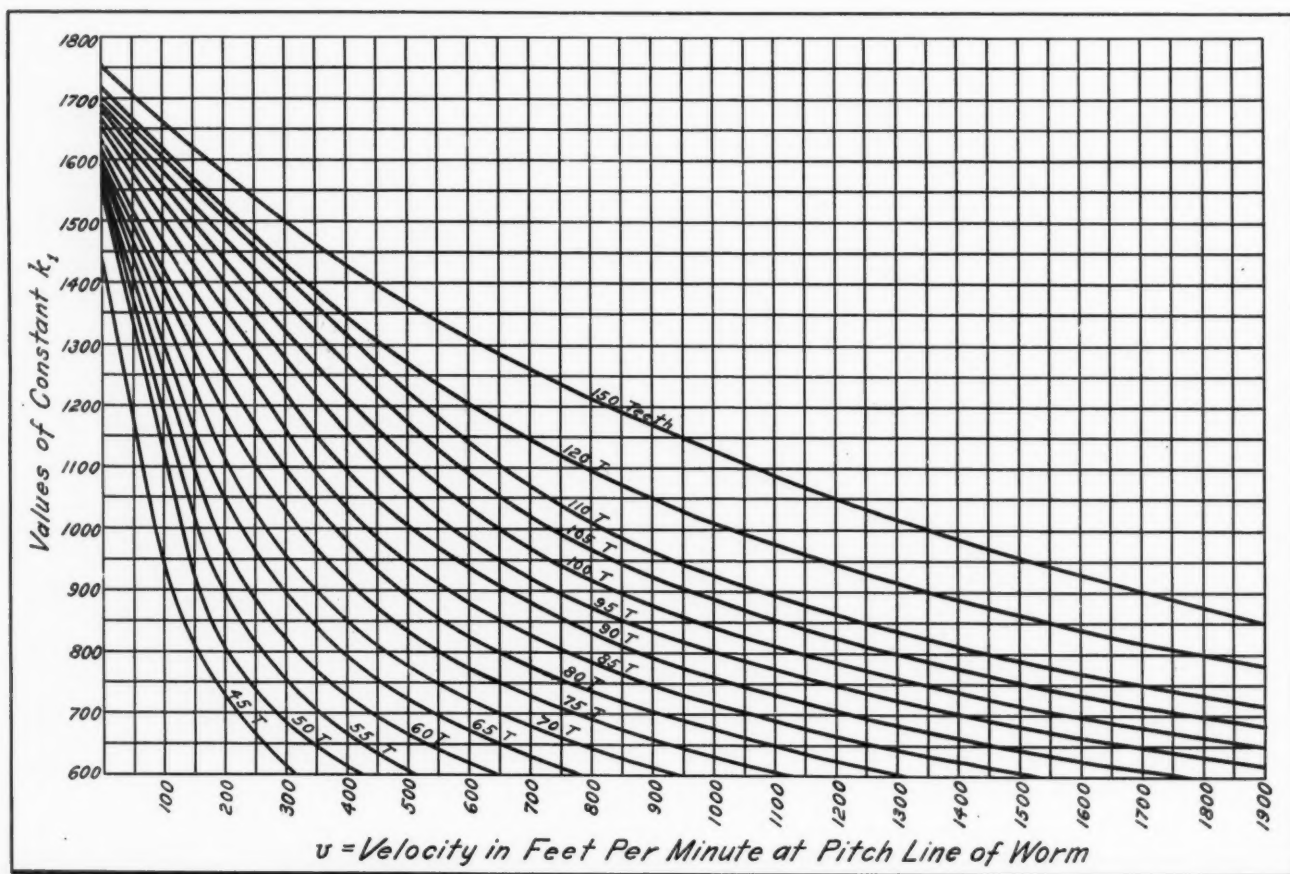


Charts for Obtaining Constants for Safe Worm-gear Load
Formula — Involute Teeth 14 1/2-degree Pressure Angle





Charts for Obtaining Constants for Safe Worm-gear Load Formula—Involute Teeth 20-degree Pressure Angle



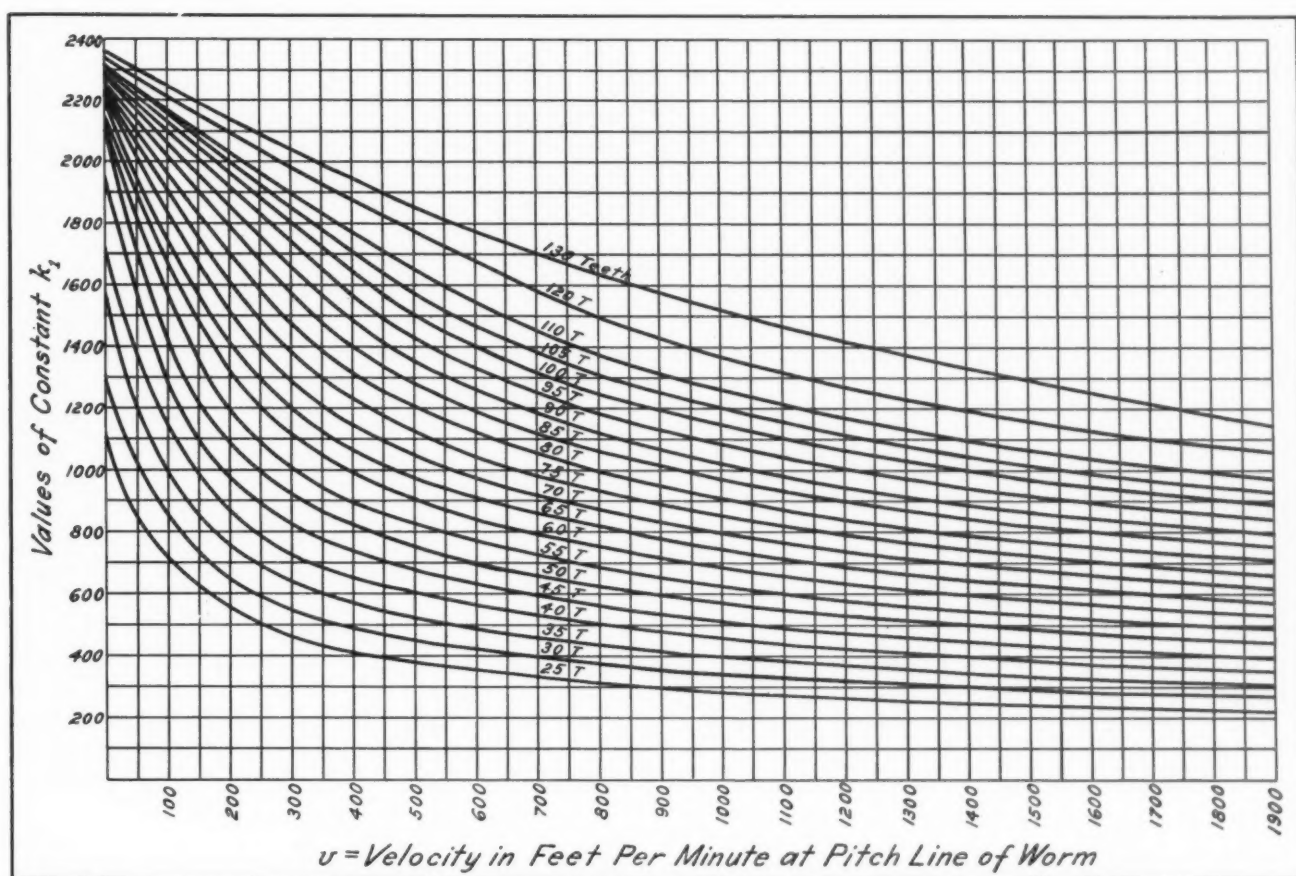


Chart for Obtaining Constants for Safe Worm-gear Load Formula—Involute Teeth 30-degree Pressure Angle

as follows: Referring to the charts shown on page 739 for 14 1/2-degree pressure angle, follow the vertical line from 710 feet per minute at the bottom of the chart to the curve for 60 teeth. Then, from the intersection of these lines, follow the horizontal line to the left-hand side of the chart

where the value of k_1 is read off as equal to 430. Inserting the known values in the given formula,

$$W = 430 \times 2 \times 0.7854 = 675$$

Hence, 675 pounds is the safe tangential load for this worm-gear.

A. G. M. A. Ratings for Speed Reducers

The recent adoption of "Recommended Practices for Rating Helical and Herringbone Speed Reducers and Heavy-Duty Worm-Gear Speed Reducers" by the American Gear Manufacturers' Association will prove of value to both buyers and manufacturers. For many years, buyers of speed reducers have found it difficult to determine the comparative capacity of such equipment offered by various manufacturers. Manufacturers, in turn, have never known if they were in fair competition with others interested in getting the business.

To solve this problem, the American Gear Manufacturers' Association appointed technical committees to work out a standardized measure of rating for adoption by the Association. These committees devoted several years' study to the problem. The adoption of their recommendations by the almost

unanimous assent of the Association proves that they have well met the requirements.

There is real need for such a standardized measure of rating, for to simply say that a reducer is good for so much horsepower at a certain speed, without any reference to stresses, wear, and other such factors, is like comparing two electric motors of the same horsepower and speed, yet with different limits of temperature rise.

The different types of service encountered in everyday use are now indicated by "service factor" or "class." As a result, the buyer of a speed reducer who specifies an A. G. M. A. rating of the service factor or class can be sure of getting what he wants. Likewise, each manufacturer seeking the business knows that he is competing for that business under fair conditions.

Questions and Answers

A. J. L.—We have a generator with an outboard bearing that runs too hot, and nothing seems to help it. A fine brand of oil is used and it is fed by pipe lines right above the ring-oilers. We have even used a blast of cold air against the bearing, but it persists in running hot. We installed the unit ourselves and are getting tired of putting in new bearings. What can be done about this?

The editor of *Oil-Ways*, published by the Standard Oil Co. of N. J., answers this question with a single sentence: "Bet the shaft is out of line."

A Matter of Implied Guarantees

J. W. W.—We have a customer who purchased a machine. He intends to sue us for damages because the machine will not perform his work. We made no guarantee, but the salesman knew the intended use of the machine. Are we liable?

Answered by Leo T. Parker, Attorney-at-Law,
Cincinnati, Ohio

The Courts recognize two kinds of guarantees, namely, expressed and implied. Briefly, an expressed guarantee is one where the seller, orally or in writing, gives a guarantee; and an implied guarantee is one where the seller does not intentionally make a warranty, but the Court implies that a warranty exists.

Generally speaking, a buyer of machinery may be successful in a litigation involving an implied guarantee, if he introduces convincing testimony to prove that the equipment failed to render reasonably good service, such as would have been expected by the average prudent user of the same kind of machinery, and that the seller, or his authorized representative, knew for what purposes the buyer intended to use the machinery.

For instance, in a recent higher Court case (150 N. W. 12), a prospective purchaser explained fully to a seller the intended uses of the equipment which he desired to purchase. The seller did not guarantee the device, but the purchaser refused to pay the purchase price when he discovered that the equipment was not reasonably adaptable to the special usage for which he intended it.

The seller filed suit to collect the amount due, but the purchaser introduced testimony to prove that the seller knew the intended uses of the device. In view of this evidence, the Court held that the pur-

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

chaser was not required to pay the contract price, saying:

"If he (purchaser) goes to a manufacturer or dealer, describing the kind of work to be done or the result he desires to accomplish, and such manufacturer or dealer professes to be able to supply goods that will do it, and the buyer is thereby induced to give him an order, then there is an implied warranty that the thing so furnished is reasonably adapted to the work for which it is procured."

Therefore, it is quite apparent that a manufacturer is liable on an implied guarantee, because the fact that he accepts an order for a machine from a salesman indicates that the latter is an authorized agent; and the agent's knowledge of the intended uses legally is equivalent to the manufacturer's own knowledge.

Either an implied or expressed warranty may be avoided by an agreement made at the time of sale in which it is clearly stated that an implied guarantee shall not be invoked, or by an agreement after the sale which cancels the original warranty. In *Bagley v. General* (C. C. A.) 150 F. 284, the language in a contract which was construed to avoid a warranty was: "It is explicitly understood and agreed that *no obligations* . . . shall be binding upon either party."

Also, in *Bean*, 169 S. W. 549, the contract, after distinctly specifying the expressed guarantee, stated: "This express warranty excludes all implied warranties." The Court held that this clause prevented the buyer from relying upon an implied warranty.

Fine-Mesh Metal Screen

R. A. D.—What is the finest mesh metal screen made?

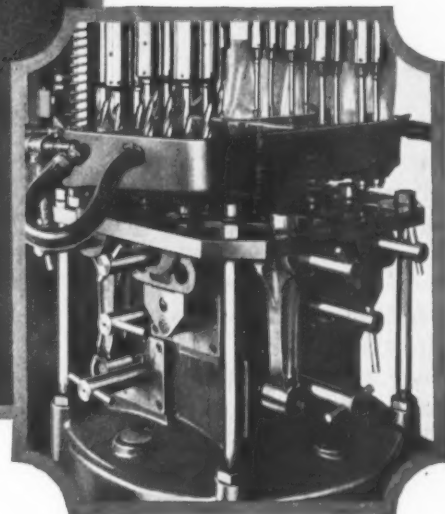
A.—A 400-square metal screen or filter cloth is the finest or smallest mesh of which we have any record.

* * *

The first shipment of motor fuel made from coal at the Billingham works of the Imperial Chemical Industries, Ltd., England, representing 300,000 gallons, according to *Industrial Britain*, was recently delivered to distributing oil companies at Ellesmere Port on the Manchester Ship Canal.



Design of Tools and Fixtures



Die for Producing Bulb Section in One Operation

By EDWARD HELLER, Cleveland, Ohio

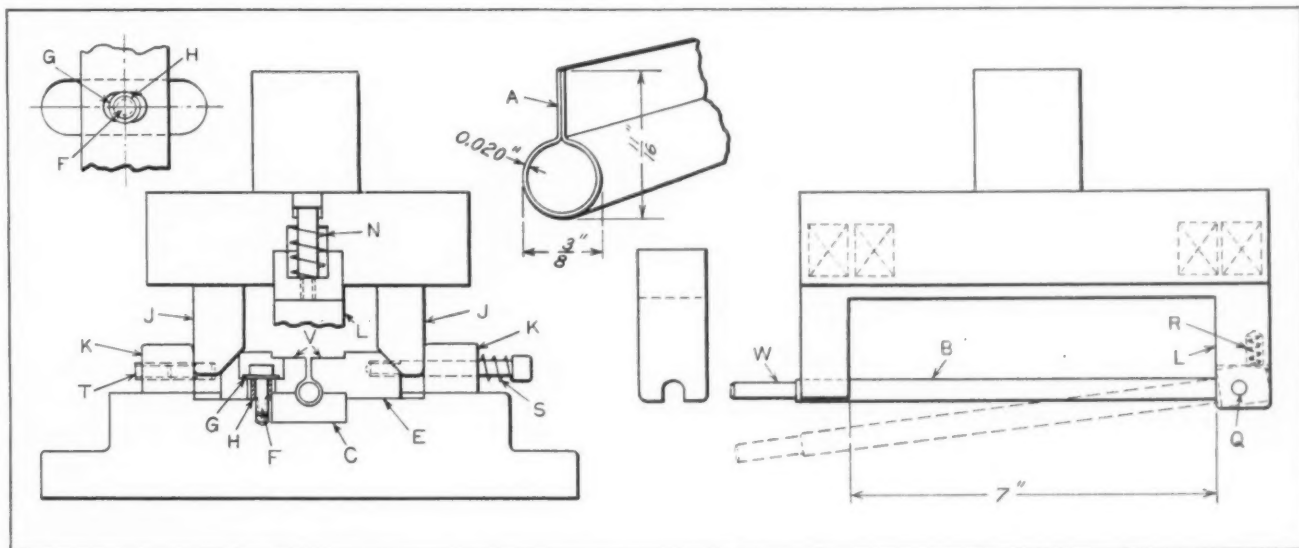
The die of rather unusual design shown diagrammatically in the accompanying illustration was developed for producing the duralumin bulb section *A* in one stroke of the press. The die is of the conventional cam and slide design. The length of the stamping, and consequently the length of the arbor *B*, is the factor presenting the chief difficulty in the production of this piece.

The die consists of a bottom block *C*, which is fastened securely in the die-shoe, and two slides *E*, which are held in place by means of screws *F*, washers *G*, and bushings *H*. The slides are operated by the cams *J*, which, in turn, are backed up by the strips *K*. The punch consists of a U-block *L* and arbor *B*. Block *L* is held in a floating position

in the punch-holder and is backed up by very heavy springs *N*. The arbor *B* is hinged at *Q* and is held up tightly against the slotted end of the U-block by the spring *R*.

In the open position, the slides *E* move outward through the springs *S* until they are stopped by four adjusting screws *T*. The blank is placed in the recess *V*, which is adjustable by means of the screws *T*. When the ram descends, the punch *L*, with its arbor *B*, comes down ahead of the cams *J* and begins to form the blank into a channel. By this time, the arbor *B* begins to spring somewhat. If this bending were allowed to continue, some damage would probably result. However, the movements of the cams are so timed that they begin to push the slides toward the center, so that they envelop the arbor, offering it a very rigid support. The arbor reaches the bottom as the slides finish their inward movement, thus completing the job.

When the ram reaches the top of the stroke, the



Die with Hinged Arbor Arrangement for Producing Bulb-shaped Section *A* from Flat Duralumin Blank

operator presses down on the front end *W* of the arbor *B*, inclining it as shown by the dotted lines, so that the work can be removed. The spring *R* then causes the arbor *B* to snap back in place, ready for the next stroke.

Of course, the tube *A* is not fully closed at the end of the operation as shown in the illustration. A certain amount of spring-back is present and it cannot be prevented, but in this case it is not objectionable. When the tube is assembled in the complete unit, the flanges of the work are riveted between two other members, so that the bulb section is forced back into the circular shape with the flanges tight together.

Die Made to Fill Rush Order for Bent, Embossed and Pierced Straps

By C. W. HINMAN, Atlanta, Ga.

An order for 2500 pieces like the one shown in Fig. 1 was required to be filled on such short notice that it was impossible to obtain a commercial die for the job. The work was completed on time, however, by using the die shown in Fig. 2, which was

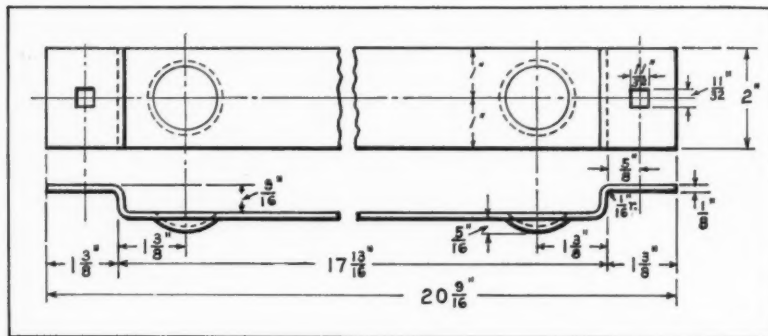


Fig. 1. Hot-rolled Steel Strap Produced by Die Shown in Fig. 2

built up very hastily for the job. Hot-rolled stock 2 inches wide by 1/8 inch thick, in lengths of 14 feet, was used for the part. The developed length of the blank was 21.4 inches.

The cast-iron die-shoe *S* with a finished cross-wise slot was incorporated in the design of the die because it was on hand. A similar but unslotted casting was used for the punch-holder *P*. The plans for the die, with all dimensions and a list of the materials required, were completed in five hours.

Two 3/4-inch pins *T* were provided for setting up and aligning the punch and die members. The strip stock is fed in at the right-hand side of the die, being guided or located sidewise between two hardened guides *A*. These guides were fitted against the right-hand side of the die-shoe slot and projected 3/8 inch above the cutting edge. The space between the guides *A* through which the stock strip is fed, was cut down far enough to allow the strip to clear the cut-off blade after it severs the strip and continues its descent while the work is being embossed and formed. The cut-off blade *B* is 7/8 inch thick and is secured in a slot cut across the punch-holder. The edge of the cut-off blade is straight, with a 5-degree shearing angle as shown. The material is pushed between the guides *A* and across the edge of the cutting-off die *C* and over spring pad *D* until stopped at the extreme left end of the die by a 45-degree angular block *E*. The object of the angular block is to force the strip against the front stop-block *F*. In this position, the strip is ready for the first operation, which consists of cutting off, bending, and embossing the two circular indentations.

The perforating of the two square holes at the ends of the work is performed in another position at the rear of the spring pad and on a lower level *G*. For this operation, the work is registered endwise in a cleared opening 17 13/16 inches long and against the two short stop-pins *H*. The formed ends of the

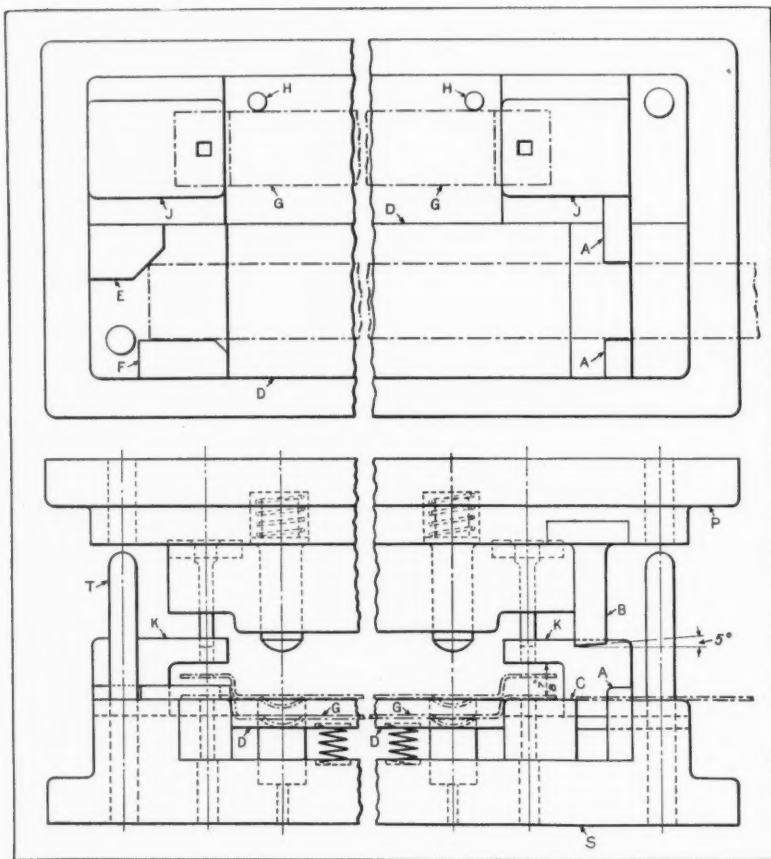


Fig. 2. Die for Cutting off, Bending, Embossing, and Piercing Part Shown in Fig. 1

work rest on the face blocks of the rectangular openings in dies *J*.

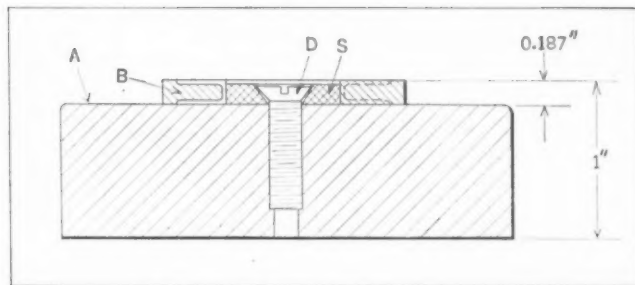
The work is stripped from the perforating punches by plates *K* when the punches ascend. Plates *K* are provided with considerable clearance space underneath, as shown. The stripping plates are firmly secured to the die-shoe. When the punch ascends, the work is carried upward 7/8 inch before it is stripped from the punches. After the part has been stripped from the punches, the inclination of the press causes the finished work to slide off the die-shoe, clearing the stop-pins *H* and falling into a receptacle at the rear of the press.

Fixture for Use in Grinding Sides of Thin Bronze Washers

By RICHARD R. HOLMES, Irvington, N. J.

The logical method for holding thin steel washers while grinding the sides parallel is to place them on a magnetic chuck. However, the holding of thin, non-magnetic washers for similar grinding operations is not quite so simple. In order to handle work of this kind, the fixture shown in the accompanying illustration was devised. It was used successfully for grinding three sizes of bronze washers *B* to a thickness of 0.187 inch.

Three cold-rolled steel disks *S*, 7/8, 1, and 1 1/8



Fixture for Holding Thin Bronze Washer while Grinding Sides

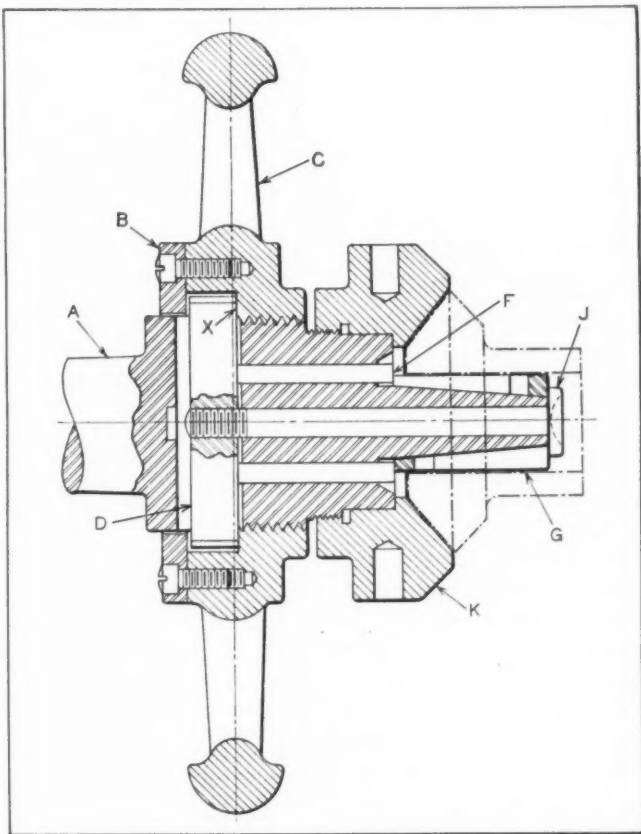
inches in diameter, were made to fit the holes in the washers and ground to about 0.180 inch thick. These disks were drilled and countersunk to receive a 1/4-20 screw *D*, and then split, the countersink being at a more acute angle than the screw head, in order to increase the side thrust. The base-plate *A* is of steel and is ground to give an accurate work-holding surface. Simply tightening the screw *D* serves to expand the disk *S* which holds the washer *B* securely while the upper surface is ground. After grinding one side, the work is removed and clamped in place with the opposite side uppermost. After grinding this side, a washer is obtained which has parallel sides.

Expanding Mandrel for Bevel Gear Blanks

By C. J. RAYMAN, Tool Designer
The Cherry-Burrell Corporation, Cedar Rapids, Iowa

In machining gear blanks from bar stock, the common procedure is to form the face angle and turn the outside diameter, back angle, hub diameter, and bore at one setting. The blank is then severed from the bar with a cutting-off tool, leaving approximately 1/32 inch on the hub face for a finishing cut. The expanding mandrel shown in the accompanying illustration was designed to insure having the face of the hub at right angles to the bore in taking the finishing cut.

The shank *A* is ground tapered to receive the split bushing *G*; slotted for the flat bar *D*; threaded with a coarse right-hand thread for handwheel *C* and a fine thread for the gage hub *K*; and reamed for the two pins *F*. When the handwheel is turned in a clockwise direction, face *X* forces bar *D*, which is attached to a draw-bar *J*, inward, causing bushing *G* to expand on the tapered end of shank *A*. By reversing the rotation of the handwheel, plate *B* is brought into contact with bar *D*, forcing it against pins *F* which, in turn, release the bushing *G* from the taper and cause it to contract. The taper on the gage hub *K* is the same as the taper on the gear blank face and acts as a gage for locating the blank longitudinally. After the mandrel has been securely placed in the lathe spindle ready for use, the gear blank is placed on sleeve *G* against



Expanding Mandrel Designed to Hold Bevel Gear Blank while Facing Hub Square with Bore

the gage hub *K*. The handwheel is then given a half turn clockwise, causing bushing *G* to expand and grip the work.

After the tool has been set properly, the cross-slide may be locked. The operation then consists merely of putting the blanks in place, facing them, and removing them without further adjustments or measurements. Blanks with bores of many other diameters and different face angles can be machined on this mandrel by providing different gage hubs and split bushings. The mandrel described is equally useful in turning the outside diameter and end of bronze bushings. For this work, the gage *K* is removed.

Back Spot-Facing Tool

The tool of rather unusual design shown in the accompanying illustration is used for back spot-facing a hole in the aluminum casting *I*. The cutter is shown at *A*, and the spot-faced surface is indicated at *Z*. The entire mechanism is effectively protected from chips and grit by seals and shields.

The cutter *A* is threaded to fit sleeve *B* and is driven by the flat *C* on bar *D* which acts on pin *E*,

fitted in sleeve *B*. Nut *F* and thrust washer *G* retain sleeve *B* on slide *H*, which is fitted with rack teeth at *J*. Pinion *K* operates between rack *J* of slide *H* and rack *L* of the operating plunger *M*.

Spring *N*, acting on plunger *M*, keeps cutter *A* in the position shown by holding the end of slot *P* against key *R* through racks *J* and *L* and pinion *K*. Key *R* also prevents rotation of slide *H*, so that rack *J* will not wedge on the teeth of pinion *K*. Stop-collars *S* limit the upward travel of cutter *A* to the finish position *Z*. Shield *T* snaps into place and can be readily removed for adjustment of collars *S*. The cutter thrust is taken by bearing *V* between sleeve *B* and slide *H*.

In operation, bar *D* (not rotating) descends into sleeve *B*. When fully entered, bar *D* starts to rotate. At this point, the adjustable stop *W* of bar *Q*, which is attached to the machine spindle head, comes in contact with plunger *M*. Continued downward movement through racks *J* and *L* and pinion *K* causes cutter *A* to feed upward from position *Y* to *Z*, finishing the operation. Withdrawal of bar *D* produces a reversal of movements.

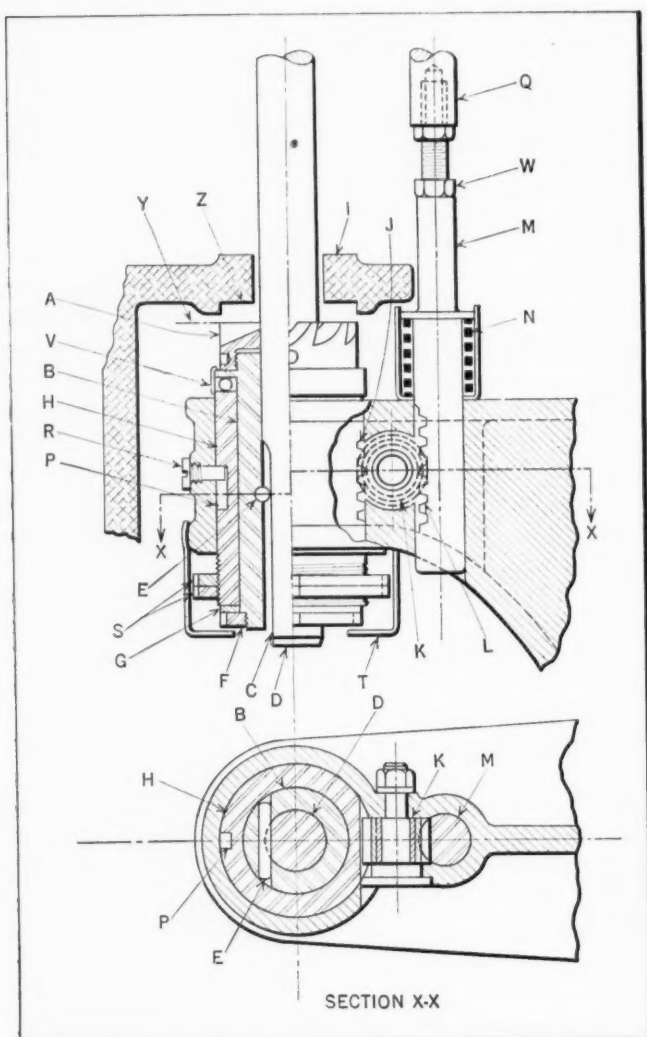
Bar *D*, in addition to driving cutter *A*, insures its squareness by keeping it in alignment with the hole. Pin *E* is a turning fit in sleeve *B*, so that the downward sliding movement of bar *D* while driving cutter *A* under load will cause pin *E* to roll and reduce friction at this point. Attention is called to the fact that cutter *A* is shown as right-hand, because the same cutter is used in other operations; thus, in this case, a left-hand rotation of the spindle as viewed from the top is required. R. P.

* * *

Correcting Errors in Assembled Parts with an Oxy-Acetylene Cutting Machine

An estimated saving of \$4000 was made recently by a chemical plant through the use of an oxy-acetylene cutting machine for reshaping the parts of a chemical agitator, according to *Oxy-acetylene Tips*. Through some error or misunderstanding, 450 low-carbon cast-steel parts were assembled in urgently needed equipment before it was discovered that the parts were too large to operate properly. The parts, each varying in thickness from 1/2 to 2 1/2 inches, were assembled on shafts, the interfering surfaces being located at the outer ends of the radial arms.

To remove the excess metal, a tapered cut of approximately 1/8 to 1/2 inch in thickness had to be taken along a path that followed not only the outward curve of the parts, but also the downward pitch. A special plate that fitted the outside curve of the work was provided with a guide for a portable oxy-acetylene cutting machine. Another guide or track, made to fit the idling wheel of the cutting machine, was attached to a templet guide. With this equipment, twelve cuts, following a compound curve path, were taken an hour, the machine being set to travel 6 inches a minute.



Tool for Back Spot-facing Hole in Aluminum Casting

A. H. Tuechter Completes Fifty Years with the Cincinnati Bickford Tool Co.

ON July 13, August H. Tuechter, president of the Cincinnati Bickford Tool Co., Cincinnati, Ohio, completed fifty years of association with the company of which he is now the directing head. It was on July 13, 1885, that he started with H. Bickford in the latter's machine tool business, which was soon reorganized under the name of the Bickford Drill Co. Mr. Tuechter was made office manager of the company in 1887.

In 1893, when this company was reorganized under the name of the Bickford Drill & Tool Co., Mr. Tuechter became general manager and partner in the business. In 1899, he entered into partnership with S. C. Schauer, who for eight years previously had been superintendent of the Hamilton Machine Tool Co., Hamilton, Ohio. Together, they formed the Cincinnati Machine Tool Co., specializing in the building of upright drilling machines, while the Bickford Drill & Tool Co. continued to concentrate on the manufacture of radial drills. In 1909, the two companies were consolidated under the name of the Cincinnati Bickford Tool Co., of which Mr. Tuechter then became president, a position that he has held ever since.

Mr. Tuechter has also long been a leading figure in many of Cincinnati's industrial activities. He is vice-president of the Ahrens Fox Fire Engine Co.; vice-president of the Cincinnati Rubber Mfg. Co.; vice-president of the First National Bank of Norwood; secretary of the Factory Power Co.; director of the Lincoln National Bank; and director of the Clyffside Brewing Co. He is also president of the Industrial Association of Cincinnati, a trustee of the Ohio Manufacturers' Association, and a member of the Administrative Council of the National Metal Trades Association. He has always taken a leading part in philanthropic and welfare work.

Mr. Tuechter is recognized as one of the prominent leaders in the machine tool industry, to whose advance he has devoted his entire life. He was

president of the National Machine Tool Builders' Association from 1920 to 1922, and has always taken a prominent part and deep interest in its affairs.

He has made an unusual number of friends, both inside and outside of the machine tool industry, and he enjoys the friendship and respect alike of employees, business associates, and customers.

In celebration of his fiftieth anniversary, Mr.

Tuechter gave a party to his employees and associates, who in commemoration of the event, presented him with a very handsome Gruen watch. The machinery dealers of the country who have been Cincinnati Bickford representatives for many years commemorated the occasion by presenting Mr. Tuechter with a beautiful Herschede hall clock. There was also a veritable flood of letters, cards, telegrams, and flowers from his many friends both far and near.

* * *

Origin of the Term "B. T. U."

Who originated the term "British thermal unit?" No one knows, it appears, although interested persons have gone to considerable trouble to find out. Joseph A. Conforti, assistant librarian

of the Peoples Gas Light & Coke Co. of Chicago, has made several years' effort to trace the origin of the term "British thermal unit" without success.

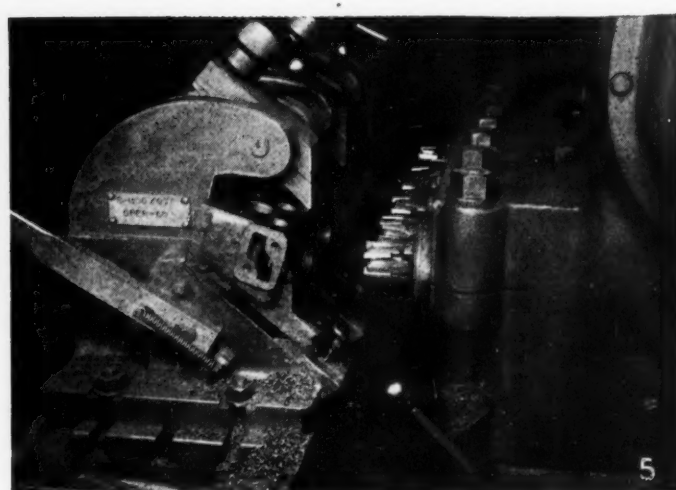
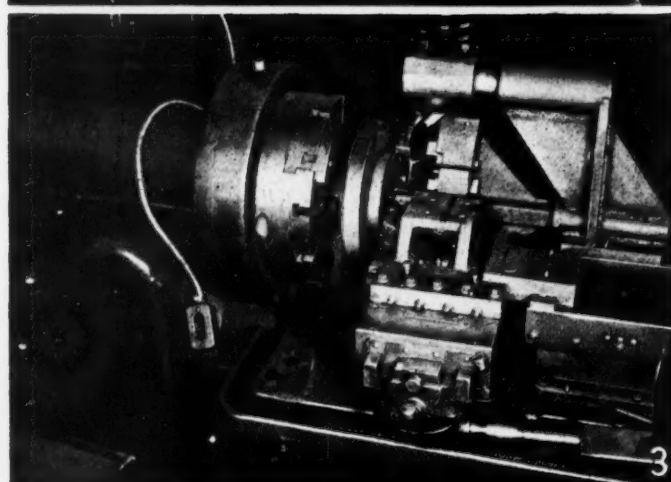
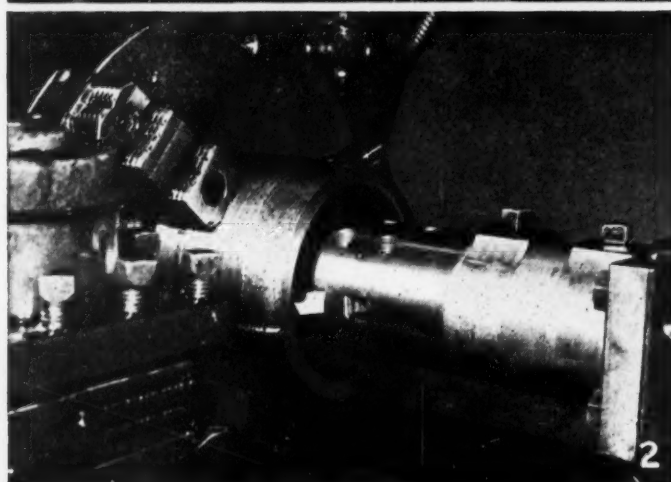
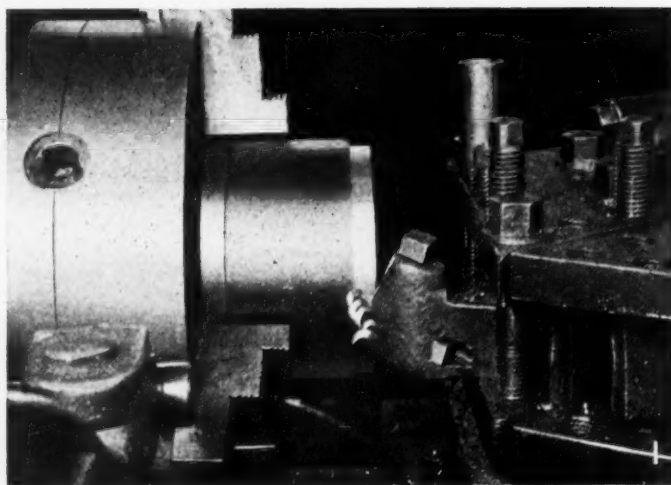
Reporting before the convention of the American Gas Association, he said that after having exhausted all sources of information in this country, he turned to the British Museum, the British Science Museum, the British Patent Office, and the British Board of Trade, as well as to the British Institution of Heating and Ventilating Engineers. He was only able to ascertain that the expression "British thermal unit" was used in a legal document as early as 1820; but who first used the term or how it came into being it has not been possible to ascertain.



Photo by Moffett-Russell

August H. Tuechter, President of the Cincinnati Bickford Tool Co., Who has just Celebrated his Fiftieth Anniversary with that Company

Use of Haynes for Machining



s g Stellite J-Metal Lycoming Motors

Fig. 6. Nine Pads and a Recess in Back of the Pads are Milled on the Cast-iron Cylinder Heads by an Inserted-blade Form Cutter that Runs at 110 Feet a Minute. Feed, 10 Inches a Minute and Depth of Cut, 1/8 Inch



Fig. 7. Four Large Inserted-blade Cutters Rough- and Finish-mill the Cap Fits and Faces on the Main Bearings of Cylinder Blocks. The Cutters Run at a Surface Speed of 115 Feet a Minute. Feed, 21 Inches a Minute and Depth of Cut, 1/8 to 1/4 Inch

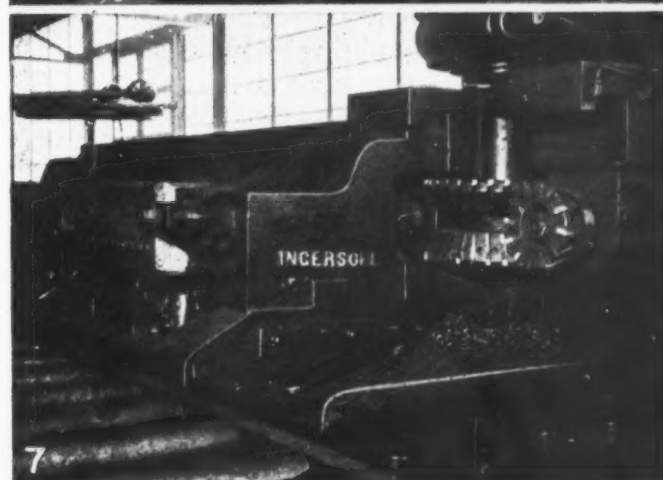


Fig. 8. Inserted Blades in Long Boring-bars Rough-bore the Main Bearings of Cylinder Blocks. Depth of Cut, from 1/16 to 1/8 Inch. Approximately 144 Pieces are Machined per Grind

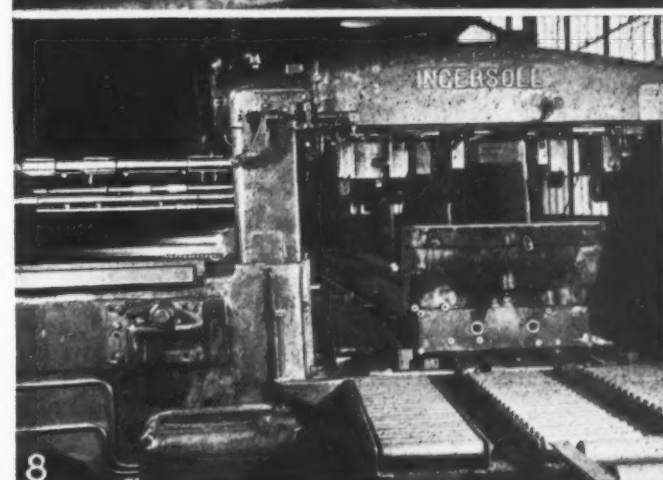


Fig. 9. In Rough- and Finish-milling the Ends of Cylinder Blocks on a Drum Type Machine, Inserted-blade Cutters Run at a Surface Speed of 114 Feet a Minute. Feed, 14 Inches a Minute. About 3/16 Inch of Stock is Removed

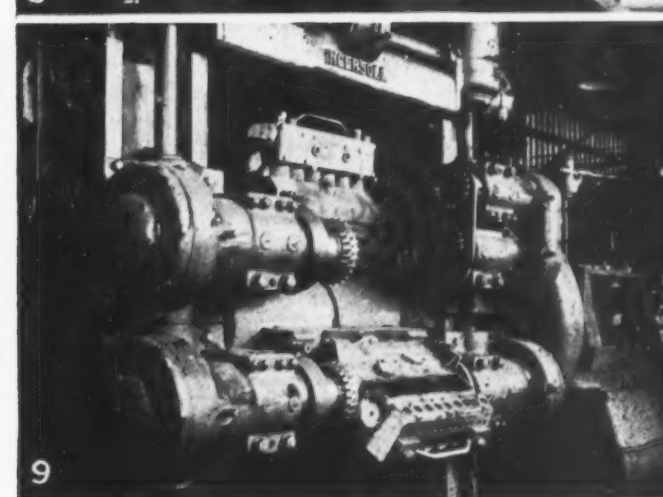
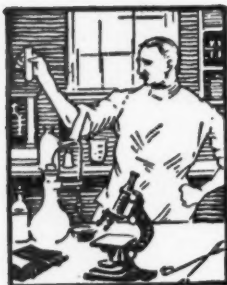


Fig. 10. Cast-iron Pistons are Turned, Faced, Cut off at Open End, Bored, Reamed, and Grooved with Stellite J-Metal Tools



MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES



Monel Metal Containing Aluminum is Non-Magnetic

When a small percentage of aluminum is added to Monel metal, the alloy becomes non-magnetic. "The White Metal News Letter," published by the International Nickel Co., Inc., 67 Wall St., New York City, states that because of this property, aluminum-Monel is being increasingly used for airplane parts located close to the compass. Steel parts, being highly magnetic, would affect the accuracy of the airplane instruments.

Aluminum-Monel is also being used for struts and guide wires on airplanes, since it possesses high strength, and at the same time, is non-magnetic.

Nickel-Alloy Cast Iron Gives Long Die Life

Both power-press dies and forging dies have recently been made from nickel-alloy steel and cast iron, materials that have proved themselves exceptionally well suited for this purpose. The Thompson Foundry, Silver Creek, N. Y., while a comparatively small foundry, has had considerable success in making power-press dies by adding small percentages of nickel, chromium, and manganese to a semi-steel consisting of 40 per cent steel and 60 per cent low-phosphorus gray iron. These dies are cast against a chill and have a Brinell hardness of 600 or more on the chilled face and of about 230 on the back of the casting.

Another type of die is a shovel-shank press die made by this foundry from castings weighing from 5 to 15 pounds each. These are cast, without a chill, to the exact size and shape, so that they only require polishing with an emery wheel before they go into the press. It is reported that 7000 dozen shovels have been produced per die from the material mentioned, which costs 12 cents per pound, against the previous production of only 700 dozen shovels per die made from a manganese-steel casting which costs 70 cents per pound. After a production of 7000 dozen shovels, the nickel-alloy semi-

steel die only needs regrinding to put it back into use. No figures are available as to the total life of these dies, but a set lasts about a year in a plant working sixteen hours a day, five days a week, the year around.

Rubber Lining Protects Tanks from Corrosive Liquids

A rubber lining known as "Plioweld" has recently been developed by the Goodyear Tire & Rubber Co., Akron, Ohio, to protect steel, aluminum, lead, or wooden tanks from the action of acids and corrosive liquids. This lining is applied to tanks of all shapes and sizes with an adhesive that is derived from rubber. This adhesive is said to actually "weld" the resilient rubber to the tank during the process of vulcanization. The adhesive itself is also a corrosion-resisting material and thus affords added protection to the tank. It is dissolved in a non-toxic solvent so that health hazards to the workmen applying it are avoided.

The usual thickness of Plioweld is 3/16 inch. It provides effective protection against most corrosive liquids, both hot and cold; it does not oxidize or slough off; and it does not crack or buckle under alternate drying and wetting.

Brass and Bronze Alloys that can be Welded

Leading brass companies have been engaged for some time in developing brass and bronze alloys that would be particularly suited to fabrication by resistance welding methods. Like any other metal, these non-ferrous alloys must meet three basic requirements in order to be considered good welding materials: First, the welding power requirements must be reasonable; second, the welds must be satisfactory from a metallurgical and a physical point of view; and third, the life of the welding points or rolls must not be too short.

Interesting results of this investigation have

been presented in *Flashes*, a publication of the Thomson-Gibb Electric Welding Co., Lynn, Mass. It is pointed out that 100 per cent copper is poor in weldability, and so is brass containing 95 per cent copper and only 5 per cent zinc. With an increase in the zinc content of brass to 10 per cent, the weldability ranges from poor to fair. Brass containing 85 per cent copper and 15 per cent zinc is fair in weldability, whereas with a copper content of 80 per cent and a zinc content of 20 per cent, the weldability ranges from fair to good. As the copper content decreases below this percentage and the zinc content increases, the weldability becomes good.

A bronze alloy containing 95 per cent copper and 5 per cent tin is fair in weldability. Commercial bronze with an analysis of 90 per cent copper and 10 per cent tin possesses good welding properties, while the weldability of an 85 per cent copper and 15 per cent tin composition is very good.

Free-Cutting Aluminum Alloys for Screw Machine Work

After lengthy research, the Aluminum Co. of America, Pittsburgh, Pa., has developed two aluminum alloys that possess the important property of being free-cutting. Both of these alloys contain copper, lead and bismuth, and one contains magnesium in addition. These alloys are especially suitable for use in the production of parts in automatic screw machines, because the chips break off short and leave the surfaces of the work clean for the tools.

Both alloys are available in two tempers, making a total of four different materials. In the T temper, which is the condition of the alloys after the application of both solution and precipitation heat-treatments, the tensile properties do not differ greatly from those of the Duralumin type alloys or free-cutting brass. In the W temper, which is a

solution heat-treatment only, the alloys are relatively soft materials of excellent machineability and can be satisfactorily cold-worked. The illustration shows a large variety of parts manufactured in automatic screw machines from rods of these free-cutting aluminum alloys.

In some applications, the free-cutting aluminum alloys have replaced free-cutting brass rod without changes being required in machine set-ups, speeds, feeds, or tool angles. This indicates the high-speed production possible with the new alloys.

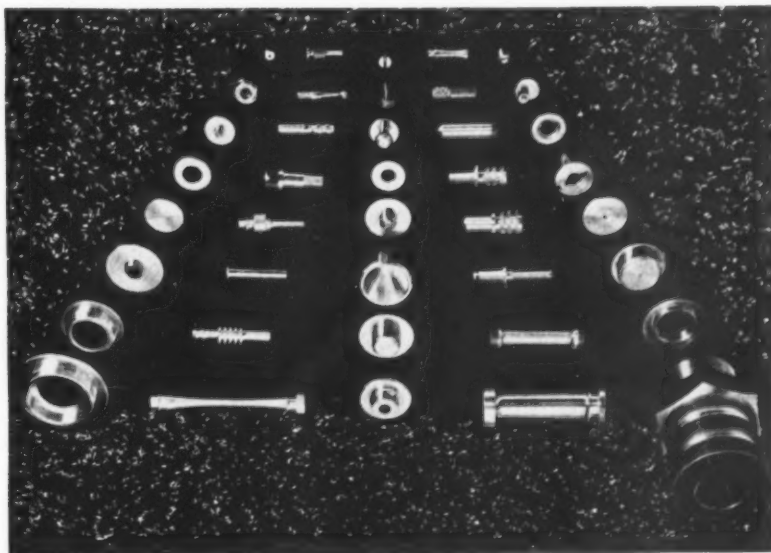
A Durez Material for the Cases of Office Machines

A Durez phenolic molding material intended specifically for use in making large moldings of the finest type has recently been announced by General Plastics, Inc., North Tonawanda, N. Y. The new material, which is known as "2260 K Black," has an impact strength approximately one-third greater than that of the general run of phenolic molding compounds. Because of this and the good finish obtained, the material is being used for instrument cases, adding-machine housings, typewriter parts, boxes, or containers that must withstand rough usage, and many decorative parts. The material has a compressive strength of 29,000 pounds per square inch and a heat resistance of 400 degrees F.

How Much Nickel is There in a Nickel?

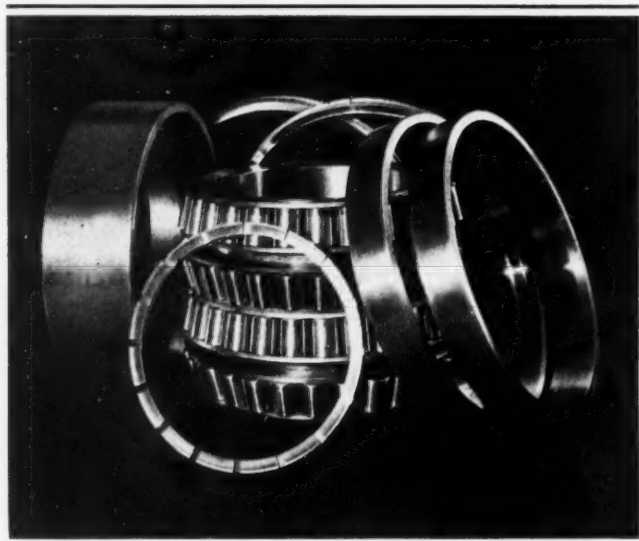
The five-cent coin of the United States Government contains only 25 per cent nickel and 75 per cent copper. There are, however, twenty-eight nations that issue pure nickel coins, including Canada, France, Germany, and Italy. Ethiopia minted 15,000,000 coins of pure nickel in 1934.

Parts Produced in Automatic Screw Machines from New Free-cutting Aluminum Alloys



Giant Steel Mill Roller Bearing

The Timken four-row unit tapered roller bearing here illustrated is one of the largest roll-neck bearings ever built. Four of these bearings, each 30 by 47 by 32 inches, will be in constant service in the Ford steel mill now being erected by the United Engineering & Foundry Co. at River Rouge, Mich. They will be installed on the back-up roll-necks of the 20 1/2- by 56- by 84-inch single-stand reversing cold mills, where rolling loads as high



Timken Four-row Bearing Designed for Loads as High as 4,500,000 Pounds

as 4,500,000 pounds at 25 revolutions per minute are anticipated.

In all, eighty-seven different sizes of Timken bearings, ranging from 2 by 3 1/2 inches up to the size of the one shown, will be used in the steel mill, involving approximately 185 tons of special steel, which is believed to be the largest single order for anti-friction steel mill bearings ever placed.

* * *

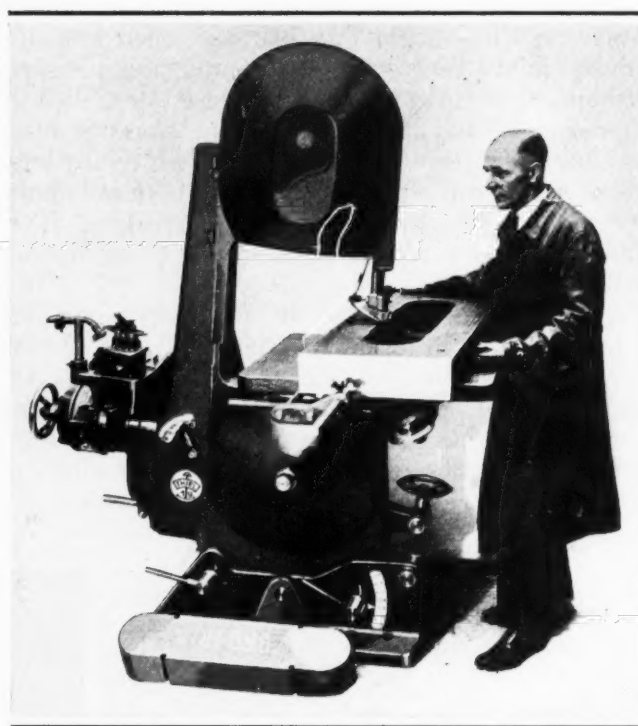
New Type Dynamometer

A new type of dynamometer, which works on the extensometer principle, has been placed on the market by the Falk Corporation, Milwaukee, Wis., under the name "Wellometer." While primarily intended for use in the oil fields, the instrument can be used wherever the amount of tension in a rod of uniform circular section can be taken as an index of the load being measured. As an example, in pre-stretching wire rope, the Wellometer can be attached to a rod fastened to the end of the rope to determine when the required amount of pre-load has been applied, the load being read directly on a dial indicator. The instrument is compact and light, weighing only 20 pounds, complete with the carrying case.

Precision Band Saw on Die Work

The cutting of openings in dies or other work requiring metal to be cut to scribed profile lines can be done accurately and rapidly on band saws like the one shown in the accompanying illustration. Standard open-end band saws are used, which are obtainable in a wide variety of tooth shapes and blade widths. When doing internal sawing, as in the case of the die shown on the machine table, one end of the saw is passed through a drilled hole in the work and quickly joined to the other end by means of the electric brazer attached to the machine. The brazed band saw is then placed on the two sheaves and the upper sheave adjusted to produce the required tension on the saw.

The machine illustrated is the larger of two Thiel high-speed precision band saws recently placed on the market by Marburg Bros. Inc., 90 West St., New York City. This machine has a capacity for sawing material up to 10 inches in thickness, and has a table 30 by 26 inches. It weighs about 1700 pounds. The machine is provided with an automatic feed, so that the operator can concentrate all his attention on guiding the cut



Cutting Opening in Blanking Die with High-speed Precision Band Saw

along the scribed line. The column of the machine can be tilted for taking angular cuts.

The smaller machine will cut material up to 8 inches in thickness, and has a table 20 by 20 inches. This machine has four speeds, while the larger machine has eight speeds. The table of the smaller machine can be tilted and accurately adjusted in four directions.

NEW TRADE



LITERATURE

Ball and Roller Bearings

S K F INDUSTRIES, INC., Philadelphia, Pa. Engineering Data Sheets covering a wide scope of bearing information. Among the subjects included are selection, mounting, and lubrication of ball and roller bearings; self-aligning ball bearings; single-row ball bearings; double-row ball bearings; spherical roller bearings; cylindrical roller bearings; ball thrust bearings; conversion tables; transmission appliances; and tables showing principal dimensions, shaft fits and tolerances, housing fits and tolerances, removable sleeves, shaft lock-nuts and lock-washers, corner radii, and shaft fillets.

Oxy-Acetylene Welding Equipment

LINDE AIR PRODUCTS Co., 30 E. 42nd St., New York City. Booklet entitled "The Metallurgy of Oxy-Acetylene Welding of Steel." This book contains an informative discussion of the physical and chemical principles involved in the oxy-acetylene welding of steel. It describes the metallurgical factors that have led to the development of modern welding rods and of the carburizing flame technique for welding steel. The advantageous heat effects of the oxy-acetylene flame are also discussed.

Welding Equipment

METAL & THERMIT CORPORATION, 120 Broadway, New York City. Booklet illustrating and describing the Thermit process of welding, employed for welding heavy sections of ferrous metals. The book covers the welding and repair of large machine parts, huge marine castings, crankshafts, and similar parts. Actual cost data are given in a number of instances.

Industrial Compressors and Vacuum Pumps

INGERSOLL-RAND Co., 11 Broadway, New York City. Catalogue 7502-D, covering the Type 30 line of industrial compressors and vacuum pumps made by this company. The compressors

**Recent Publications on
Machine Shop Equipment,
Unit Parts, and Materials.
Copies can be Obtained
by Writing Directly to
the Manufacturer.**

sors described include single-stage, single- and twin-cylinder, and two-stage machines. Numerous industrial applications are illustrated.

Pumps for Hydraulic Drives

AMERICAN ENGINEERING Co., Philadelphia, Pa. Catalogue covering Hele-Shaw pumps, motors, regulators, differential valves, and pipe testing machines. The catalogue contains many illustrations, charts, tables, drawings, and engineering data indicating the construction, operation, application, and specifications of these products.

Alloy Steels and Irons

ELECTRO METALLURGICAL Co., Unit of Union Carbide & Carbon Corporation, 30 E. 42nd St., New York City, is distributing a monthly publication known as *The Electromet Review*, the purpose of which is to bring to industrial executives in quickly readable form authentic news of the rapidly increasing uses of alloy steels and irons.

Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin W-103-B1, dealing with Worthington horizontal duplex piston pumps for general service. Bulletin W-317-B4, on single-stage volute vertical centrifugal pumps. Bulletin L-800-B1, descriptive of air-lift pumping systems operated by air compressors.

Aluminum Alloys

ALUMINUM Co. OF AMERICA, Pittsburgh, Pa. Booklet entitled "Alcoa Aluminum and Its Alloys," describing

ing the properties of the different alloys and the application for which each is best suited. Information is also given on the forms in which these materials are available and the sizes that are in commercial production.

Power Transmission Equipment

MEDART Co., Potomac and De Kalb Sts., St. Louis, Mo. General catalogue 56-T, covering the Medart complete line of power transmission equipment, including shafting, rope drives, V-belt drives, pulleys, pillow blocks, bearings, clutches, couplings, belt tighteners and adjusters, hoisting sheaves, etc.

Gears

GRANT GEAR WORKS, Second and B Sts., Boston, Mass. Catalogue and price list No. 58, covering this company's complete line of stock and special gears, sprockets, and speed reduction units. In addition to listing the various sizes and prices, the catalogue contains data on spur and bevel gears of use to the designer.

Belt Preservatives

E. F. HOUGHTON & Co., 240 W. Somerset St., Philadelphia, Pa. Folder entitled "Houghton on Belt Preservatives," containing information on how, when, and why to use belt preservatives or dressing. The circular also tells which preservatives are best suited for different types of belts.

Lubrication Equipment

ALEMITE CORPORATION, 1826 W. Diversey Parkway, Chicago, Ill. Revised catalogue on Alemite "Power-gun" equipment. The catalogue shows illustrations of all the equipment and accessories necessary for a lubrication job and gives full details and specifications, including prices.

Electric Equipment

OHIO CARBON Co., 12508 Berea Road, Lakewood, Ohio. New edition of booklet entitled "The Brush Phase of Motor Maintenance." A new feature of this edition is a series of

illustrations showing the company's testing system for maintaining its standards of quality.

Metal Spraying Equipment

METALLIZING CO. OF AMERICA, INC., 1218 Long Beach Ave., Los Angeles, Calif. Pamphlet listing many uses of metal-spraying equipment on general maintenance applications. The illustrations show metallizing jobs that have been in service a number of years.

Industrial Thermometers

C. J. TAGLIABUE MFG. CO., Park and Nostrand Aves., Brooklyn, N. Y. Catalogue 1125, containing conveniently arranged listings of the complete Tag line of industrial thermometers, hygrometers, U-gages, mercurial vacuum gages, and mercurial barometers.

Air Compressors

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletins L-620-B8 and L-621-B6, illustrating and describing, respectively, Worthington vertical two-stage air compressors, and Worthington vertical single-stage air compressors.

Cold-Drawn Steel

UNION DRAWN STEEL CO., 232 Harsh St., Massillon, Ohio. Circular entitled "Many Steel Parts Are Bought for Less Money by the Foot," showing in a striking manner examples of parts made by the use of Union cold-drawn special shapes.

Electric Furnaces

HEVI DUTY ELECTRIC CO., Milwaukee, Wis. Bulletin HD-635, illustrating and describing Hevi Duty Pott type electric furnaces used for the immersion method of heat-treating small parts, and for melting, tinning, galvanizing, etc.

Tools

BONNEY FORGE & TOOL WORKS, Allentown, Pa. Catalogue 35, covering the line of tools made by this company, which includes wrenches, wrench sets, screwdrivers, punch and chisel sets, and pliers. Complete price lists are included.

Taps and Dies

WINTER BROS. CO., Wrentham, Mass. Catalogue 17, covering the complete line of carbon and high-speed steel taps and dies made by

this company. A separate section contains specifications for screw plates, including prices.

Die-Heads

EASTERN MACHINE SCREW CORPORATION, Truman and Barclay Sts., New Haven, Conn. Bulletin illustrating and describing H & G insert-chaser die-heads. Tables of dimensions are given for the different sizes and styles of heads.

Tool Engineering

CIMATool Co., East Third and June Sts., Dayton, Ohio. Bulletin entitled "How Tooling Costs are Being Reduced," describing the service offered by this company in tool engineering and the design and manufacture of dies.

Portable Pneumatic Tools

ROTOR AIR TOOL CO., Cleveland Ohio. Bulletin illustrating various applications of Rotor air tools, including vertical and horizontal grinders, die grinders, wire brushing tools, buffers, sanders, and cone grinders.

Bronze Powder

O. HOMMEL CO., Pittsburgh, Pa. Pamphlet entitled "The Why and How of Bronze Powder," outlining the method of production, qualities uses, and methods of applying bronze powder for decorative purposes.

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GEA-77H entitled "Improving Power Factor for Profit," illustrating and describing GE Pyranol capacitors for the improvement of power factor.

Thread-Cutting Machinery

LANDIS MACHINE CO., INC., Waynesboro, Pa. Folder entitled "Let's Talk about Performance," containing production data showing the results obtained with Landis threading machines and tools.

Nickel-Alloy Cast Irons

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Booklet describing the properties of nickel-alloy cast irons and their special applications in petroleum production equipment.

Microscope Accessories

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y. Catalogue cover-

ing Bausch & Lomb microscope accessories, such as eye-pieces, objectives, condensers, nose-pieces, micrometer disks and eye-pieces, etc.

Pressure Regulating Valves

MCALLEAR MFG. CO., 1901 S. Western Ave., Chicago, Ill. Bulletin descriptive of all types of regulators for reducing and controlling steam, water, air, gas, and oil pressures.

Safety Switches

ELECTRIC CONTROLLER & MFG. CO., Cleveland, Ohio. Circular listing the features of the EC & M Type A safety switches, especially suitable for industrial applications.

Motorized Speed Reducers

JANETTE MFG. CO., 556 W. Monroe St., Chicago, Ill. Bulletin 22-10, containing complete data, including prices, for the Janette line of motorized speed reducers.

* * *

Bicycle Industry is Still a Big Business

According to *Flashes*, published by the Thomson-Gibb Electric Welding Co., Lynn, Mass., the bicycle industry throughout the world is not losing its hold, but rather is increasing in importance. While bicycles may be used only to a limited extent in the United States, as compared with their great popularity of thirty-five years ago, no one who has recently visited Europe can conceive of the bicycle as a thing of the past. The streets of every city in Great Britain and the Continent are filled with cyclists; and what is more interesting, the millions in India, China, and Africa are beginning to use bicycles to an ever increasing extent. In fact, a dozen large, well-known concerns in England and on the Continent are turning out anywhere from 1000 to 3000 bicycles a day.

In the bicycle industry, the same problems have had to be met as in the automobile industry—how to cut down weight without sacrificing strength, and how to reduce costs. Welding methods have aided greatly in solving both of these problems. Expensive castings have been replaced by inexpensive projection-welded stampings, and costly riveting and brazing operations have been eliminated by substituting flash welding.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

New Line of New Britain Automatics with Self-Stopping Feature

Bar type automatic screw machines of a line recently developed by the New Britain-Gridley Machine Co., New Britain, Conn., stop by themselves whenever the stock in any spindle is too short to permit the machining of a complete piece of work. When the machine stops, a red light flashes to notify the operator. This automatic stopping feature guards against the breakage of tools, because there is no chance of machining stock that is inadequately supported in a collet. It also insures maximum daily production by avoiding idle running of any spindle. The machine stops with all tools withdrawn and with the collet that requires stock open, ready to receive a new bar.

Another important feature of these machines is that the spindle-carrier is completely lifted from its bearing surface during indexing movements, so as to eliminate wear of the surfaces on which the accuracy of an automatic screw machine entirely depends. Such provision is said to be of especial importance with high-speed machines, because of the frequency and rapidity of the indexing movements. The machines of this new line can be indexed in as short a time as 0.263 second. After each indexing, the spindle-carrier is pulled firmly down on a large semicircular bearing surface and locked during the cutting cycle.

Preloaded ball-bearing mountings prevent radial or axial deflection of the spindles even under the heaviest cuts, and enable the spindles to be made unusual-

ly short. Other features of the new machines include the use of forming slides mounted on hardened cylindrical studs, entirely protected from chips and grit, thus preserving the initial accuracy; spherical roller chucking devices which are not affected by centrifugal force; a stock-feeding mechanism so designed that any length of stock can be fed with one set of cams; and a gage connected to the lubricating system which operates a switch that prevents the motor from running in the event that any part of the machine is not receiving oil at a predetermined pressure.

This new line of automatic screw machines is built in three models, Nos. 40, 41, and 60. The

Model 40, which is here illustrated, is of the four-spindle type and is built in two sizes, namely, 7/8 inch by 5 inches and 1 inch by 5 inches. The Model 41, which is also of the four-spindle type, is built in several sizes from 1 3/8 by 6 inches up to and including 2 1/4 by 6 inches. The Model 60, which is of the six-spindle type, is built in two sizes, 5/8 inch by 5 inches and 1 inch by 5 inches. Production rates as high as 3425 pieces an hour are obtainable on both Models 40 and 60.

Spindle speeds on the Models 40 and 60 range from 300 to 3800 R. P. M. Spindle speeds on the Model 41 range from 199 to 2485 R. P. M., with production rates up to 1018 pieces per hour.

In addition to the above-mentioned models, the new line of New Britain automatics includes

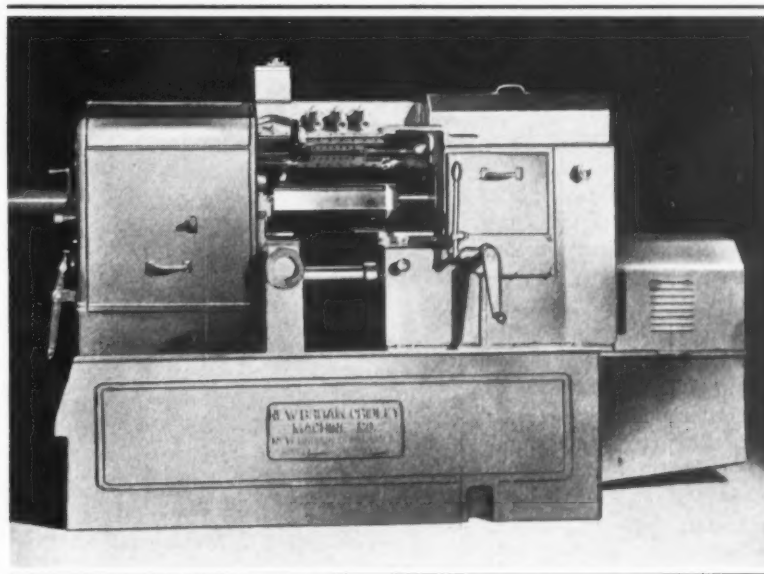


Fig. 1. New Britain Automatic Screw Machine which Stops by Itself when the Stock is too Short for Machining a Full Length Piece

SHOP EQUIPMENT SECTION

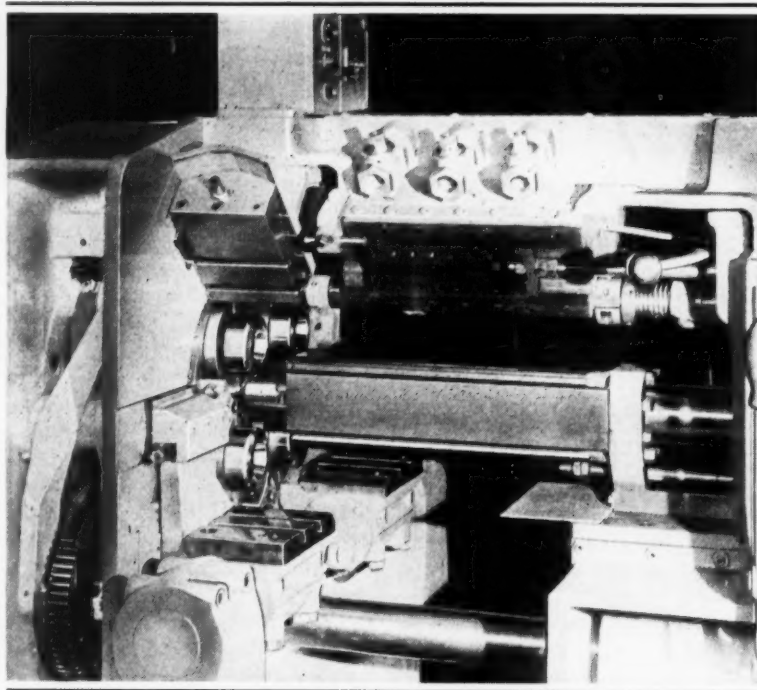


Fig. 2. Three of the Cross-slides on the Latest New Britain Automatics are Mounted on Cylindrical Studs to Minimize Wear

the Model 14 four-spindle automatic chucking machine with a chuck capacity of 6 3/4 inches. This machine is similar in design to the Model 41 screw machine.

The machines of the new line are started by depressing a push-button on the switch box mounted on top, as seen in Fig. 2. In this unit is incorporated a semi-automatic stop switch which facilitates setting up. When this switch is thrown in, the machine will make one complete cycle and then stop with all slides withdrawn. In the normal operation of the machine, it will run without stopping until the amount of stock in any spindle collet is too short to produce a complete piece. As the empty feed-tube is pushed back into the stock-feeding position, a solenoid is de-energized, causing the machine to stop and flash on a red light, as previously mentioned. Before the operator can reload the empty stock feed-tube, he must pull back a lever, which depresses a push-button and stops the motor. This arrangement prevents injury to the operator or to the machine from

accidental starting during loading.

The power box at the right-hand end of the machine, which includes the speed-change gears, the drives to the various drums, the spindle-carrier, and the drive for revolving tools, is entirely enclosed and automatically lubricated. All shafts run in anti-friction bearings. The feed clutches and the high- and low-speed clutch are of the multiple-disk type.

The spindle-carrier unit and a spindle assembly are illustrated

in Fig. 3. The lifting of the carrier from its bearing in the machine frame prior to each indexing is accomplished through the action of a cam-operated bell-crank lever. The carrier is locked in each indexed position by hardened and ground blocks (on opposite sides of the carrier) that enter two of four slots formed by hardened and ground pieces, as shown at A. One side of each block is ground square and the other side tapered, so as to pull the carrier down approximately 0.008 inch to its bearing surface.

The method of mounting the cross-slides on large-diameter studs, as already referred to, is illustrated in Fig. 2. The bearings of these slides are entirely enclosed, so as to prevent chips or dirt from getting between the bearing surfaces. Hardened and ground tool-holder bases are provided on the slides, the T-slots of these bases being parallel with the spindle axes. The cross-slide cams are of the flat-disk type. They are jig-drilled, and are interchangeable in any of the four cross-slide positions.

The tool-slide is actuated by a drum for which universal cams can be provided to suit a wide variety of work. These cams adapt the machine to short-run jobs, as they obviate the necessity of changing cams. Feeds from 0.0008 to 0.158 inch per revolution of the work can be provided for the tool-slide through change-gears, and cross-slide feeds from 0.00013 to

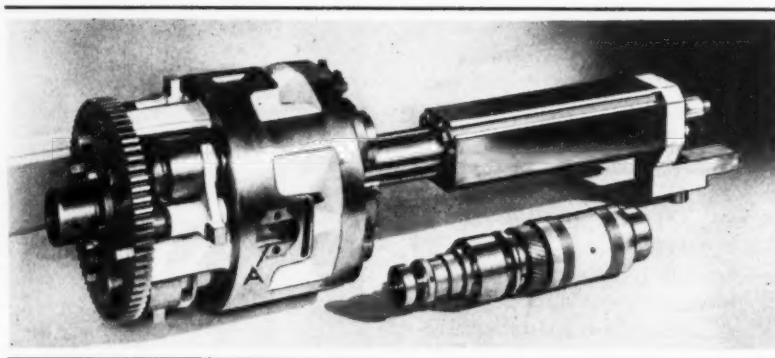


Fig. 3. The Spindle-carrier Assembly, which is Completely Lifted from its Bearing Surface during All Indexing Movements

0.0144 inch per work revolution. The feed-change and speed-change gears are interchangeable.

The stock is fed and cut off in the upper front position, where the stock stop is free from chips and at the most convenient position for inspection by the operator. Tapping can be performed in all of the top positions by means of an interchangeable attachment. Threading with a self-opening die can be done in all positions. Drill speeders of a preloaded ball-bearing design can be supplied for use in any position of the work. Self-opening dies can also be employed with this attachment. The weight of the Model 40 machines is approximately 7500 pounds, and of the Model 41 machines, 11,800 pounds.

Linde Medium-Pressure Acetylene Generators

Three sizes of medium-pressure acetylene generators for stationary service, designated as Oxweld Type MP-5, having carbide capacities of 150, 300, and 500 pounds, with acetylene generating capacities ranging from 300 to 1000 cubic feet per hour, have been brought out by the Linde Air Products Co., 30 E. 42nd St., New York City.

Each generator has all the controls protected by a housing which can be padlocked to prevent unauthorized persons from operating the generator or tampering with it. The gravity type feed control unit is self-contained and is bolted to the inside of the upper section of the generator. A sensitive diaphragm type feed control is provided, which is designed to release just the right amount of carbide to maintain the gas at a constant pressure.

Rapid emptying and recharging of the generator is made possible through a large lubricated plug valve for draining the carbide residue, a water filling valve of similar construction, and an unusually large carbide charging door.

Lehmann Lathe with Hydraulically Controlled Speed Changes

The "Hydratrol" lathe, now being introduced on the market by the Lehmann Machine Co., Chouteau and Grand Blvd., St. Louis, Mo., represents an unusual development in machine tool design in that the spindle speeds are selected through a rotary valve which hydraulically controls the engagement and disengagement of three friction clutches and three sliding

ing member of the slide-rule, whereas the cutting speeds are shown on the stationary scale.

In changing the spindle speed to a predetermined requirement, the operator merely turns the speed-changing handle until the proper work diameter registers with the specified cutting speed in feet per minute. The device makes it easy not only for the operator to obtain the correct

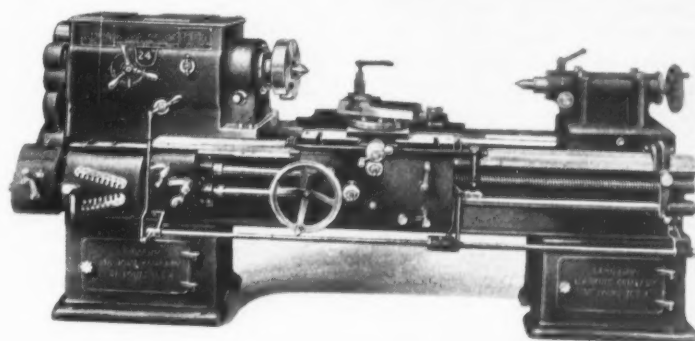


Fig. 1. "Hydratrol" Lathe on which Speed Changes are Accomplished by Means of Hydraulically Actuated Clutches

clutches in the headstock. The friction clutches are mounted on the pulley drive-shaft to give a slow forward speed, a high forward speed, and a reverse rotation. The three sliding clutches are of the external and internal gear type. They provide sixteen forward spindle speeds and eight reverse speeds.

Speed changes are effected by turning the triple handle on the front of the headstock. Any desired speed can be obtained without stopping the lathe, it being unnecessary to disengage the friction driving clutch. An automatic slide-rule on the front of the headstock (see Fig. 2) shows the number of spindle revolutions being made per minute and indicates a slide-rule calculation of the cutting speed in feet per minute corresponding with work diameters within the range of the lathe. The work diameters are given on the slid-

cutting speeds, but also for the supervisor to check the operation at a glance.

The control lever is below and to the right of the speed-change handle. It has three positions—forward, stop, and reverse. This handle permits operation of the lathe at the headstock, and it is connected to a handle on the apron for controlling the machine from that point. The start-and-stop control is unusually sensitive, it being stated that at a speed of 96 revolutions per minute the spindle can be started and stopped from twenty to thirty times in one revolution. This feature is especially useful for inching the spindle to a desired position.

Changing of speeds without disengaging the friction driving clutch is made possible by an automatic safety relay, which also avoids clashing of the positive clutches. These clutches

SHOP EQUIPMENT SECTION

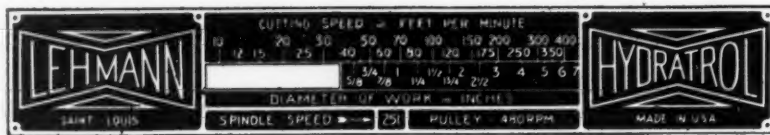


Fig. 2. Automatic Slide-rule which Shows the Cutting Speed in Feet per Minute for Various Work Diameters and Revolutions per Minute

are actuated by double-acting hydraulic cylinders and pistons of the type shown in Fig. 3. Forks fastened to the center of the pistons move the positive clutches into the operative positions determined by the selector valve. Hardened cams fastened to the forks operate the relay valve which provides an initial fast movement of a clutch for disengagement, the application of brakes, and a slow movement of the piston. Before the positive clutch enters its opposite mating position, the brakes are released, a slight drifting of the friction clutch occurs, and an accelerated movement of the positive clutch takes place for easy engagement.

Two hydraulic brakes are provided on the machine, one at the primary power source and the other on the spindle. The spin-

dle is released for chucking by turning a small T-handle on the front of the headstock, so as to disengage the positive clutch and brake which are mounted on the spindle.

Hannifin Sensitive Straightening Press

A 35-ton hydraulic press especially designed for the accurate straightening of automobile axle shafts, crankshafts, and similar work has been developed by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill. Simplified handling of straightening operations and increased production are advantages claimed as a result of the control mechanism, which consists of a single lever that controls the entire operation of the ram.

The pump and reservoir for the hydraulic control are mounted on the back of the headstock. The lathe is also equipped with a pump and reservoir at the back of the carriage for lubricating the carriage, cross-slide, and taper attachment. Timken tapered roller bearings are provided for the spindle. This lathe is built in swings of 16, 18, 22, and 24 inches. Applications have been made for patents to cover the essential features of the design.

When this lever is moved in either direction, the ram will move a proportional distance and then be stopped by automatically bringing the operating valve to neutral. An accurate ram movement either up or down of as little as 1/16 inch can be obtained. The control-lever movement is about three times that of the ram stroke, thus giving unusually sensitive operation without requiring special skill on the part of the operator.

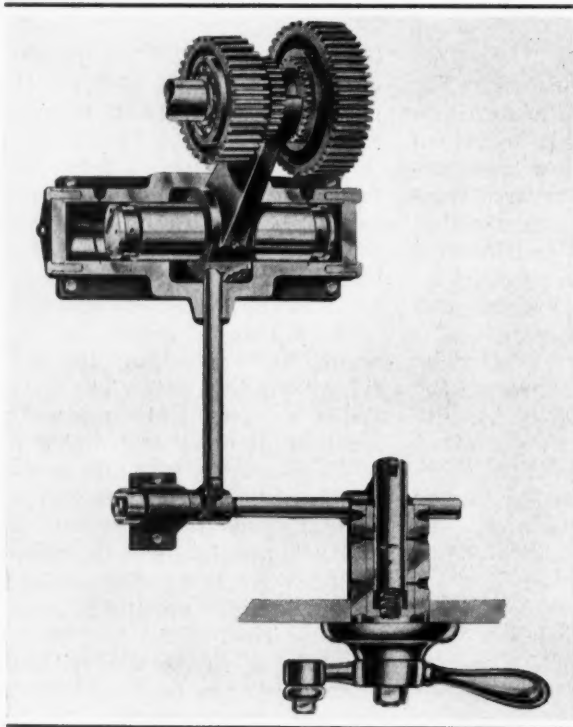
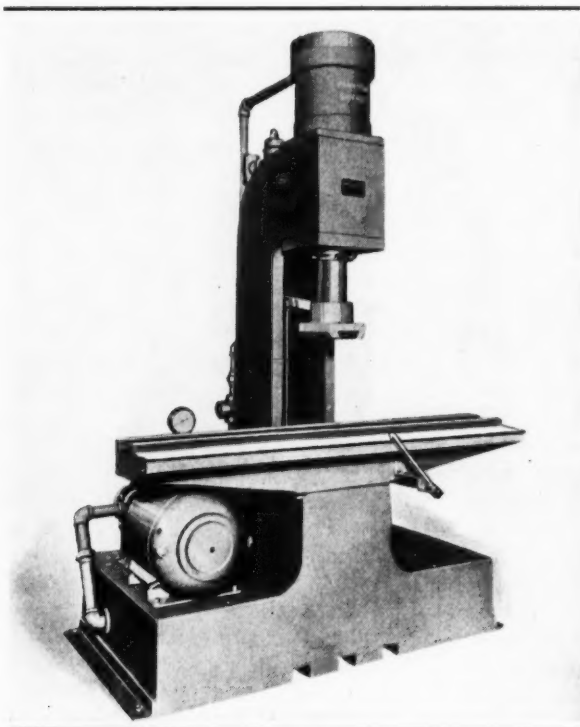


Fig. 3. Positive Clutch, with its Fork, Piston, and Cylinder and Connection to Speed-change Lever



Hannifin Hydraulically Operated Straightening Press with Unusually Sensitive Action

SHOP EQUIPMENT SECTION

The hydraulic power unit, which includes a constant-delivery type of rotary pump, is built into the base of the press, providing a self-contained machine that occupies only about 19 square feet of floor space.

The ram can be fitted with any type of fixture to meet requirements. It has a stroke of 6

inches. The power stroke is made at a speed of 53 inches a minute, and the return stroke at 77 inches a minute. The maximum distance between the table and the ram is 20 inches, the distance from the center of the ram to the face of the frame is 9 inches, and the length of the table is 70 inches.

Bliss High-Production Press

The latest addition to the line of high-speed automatic presses built by the E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio, is made in a non-g geared model which operates at speeds up to 300 strokes a minute and in a longer-stroke geared model which can be operated up to 175 strokes a minute. The latter model is designed for performing drawing operations of considerable depth.

This machine has a width of 48 inches between housings, which adapts it to using long follow dies. The press is rated at from 45 to 65 tons, depending

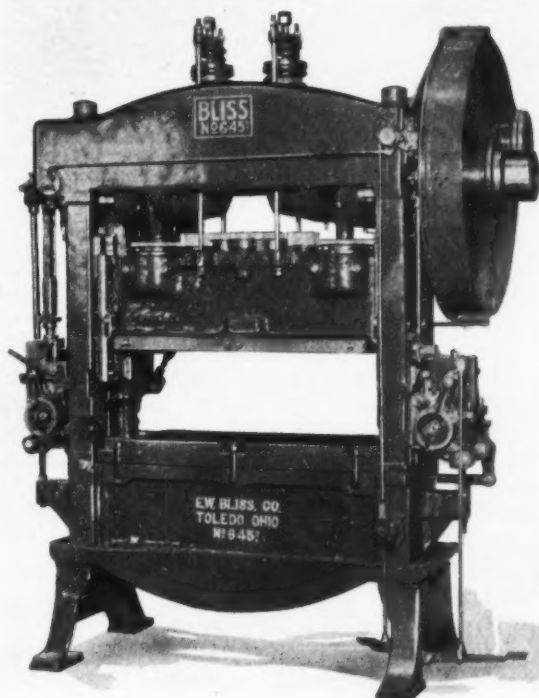
upon the character and duration of the load. Heavy sections, a special gibbing of unusual accuracy, a double-crank construction with a heavily ribbed crown and a shrunk tie-rod frame are among the features that contribute toward long die life.

The equipment includes high-speed double-roll feeds, a scrap shear provided with an adjustment for blade clearance, a spring counterbalance for the slide, and automatic force-feed lubrication. A foot-controlled mechanism provides a convenient means of starting and re-starting coil stock.

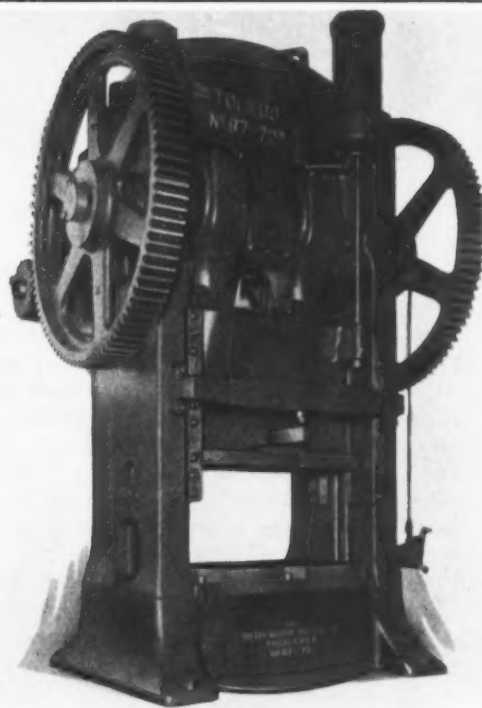
Toledo Streamline Punch Presses

Corners and dust-pockets on punch presses built by the Toledo Machine & Tool Co., Toledo, Ohio, are being eliminated and the lines of the machines smoothed out wherever possible. While this procedure necessarily improves the appearance of the presses, there is back of it a carefully worked out plan for increasing the strength of the press sections by distributing the metal in the most desirable manner.

The No. 97 twin-driven press illustrated is one of the latest designs. The frame members are high-test alloy castings possessing a high modulus of elasticity that provides much greater stiffness of the bed and slide members than previously. Shrunk steel rods protect the press from being overloaded during heavy bottoming operations. The press is equipped with a mechanically controlled self-adjusting pneumatic friction clutch that enables high production rates to be



Bliss Press with Patented Features, which Operates at Speeds up to 300 Strokes a Minute



Toledo Press Redesigned to Improve Appearance and Increase Strength

SHOP EQUIPMENT SECTION

attained. The equipment also includes pneumatic counterbalance cylinders, a cross-bar knock-out in the slide, and a direct-connected lift-out in the bed.

Williams Non-Sparking Safety Wrenches

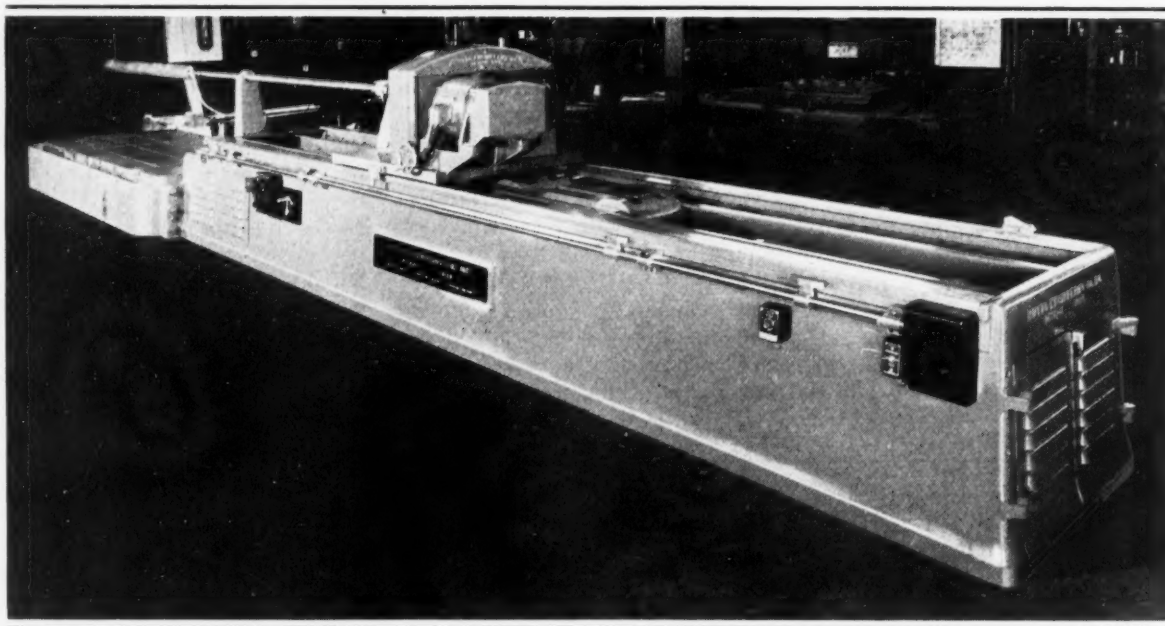
A line of non-sparking safety wrenches, recently announced by J. H. Williams & Co., 75 Spring St., New York City, has been developed especially for use in industries where great fire hazards

Hutto Honing and Lapping Machine for Long Bores

Bores from 1 1/2 to 12 inches in diameter can be honed or lapped on a hydraulically reciprocated machine of horizontal style, introduced on the market by the Hutto Engineering Co., Inc., 515 Lycaete Ave., Detroit, Mich. The stroke of this machine can be varied from a minimum of 2 inches to a maximum of 13 feet 6 inches. Any speed of reciprocation from 0 to 50 feet a minute is obtainable. The reciprocating motion is pro-

videpower motor provides power for rotating the honing and lapping spindle. The coolant pump, which has a capacity for delivering 50 gallons per minute, is driven by a 1/2-horsepower motor.

The manufacturer mentions that in the Rock Island Arsenal, a machine of this type was recently employed to refinish a 100-millimeter (3.9370-inch) recoil cylinder, 92 inches in length, which was 0.003 inch out of



Hutto Honing and Lapping Machine for Bores from 1 1/2 to 12 Inches in Diameter

exist. These wrenches are drop-forged from beryllium copper, which will not cause sparks when dropped on cement floors or struck against other materials from which sparks would be generated by steel wrenches. They are accurately heat-treated and are said to be practically as strong as steel wrenches of similar design and size.

In addition to being non-sparking, these wrenches are non-corroding. They are finished in green enamel, the heads being polished and stamped with their respective opening sizes. Both single- and double-head patterns are available in a wide range of sizes.

duced hydraulically and transmitted through gearing. The action of the hydraulic cylinder is considerably slower than the speed of the machine table.

The honing and lapping spindle can be run at any speed from 53 1/2 to 252 revolutions per minute to obtain the desired finish on surfaces. Stops arranged along the bed prevent over-running of the table. The machine is completely automatic, there being an electric stroke counting and controlling device which can be set to stop the machine after any number of strokes from 1 to 999. A 7 1/2-horsepower motor supplies power for the reciprocating action, and another 7 1/2-

round and tapered 0.007 inch. It was possible to remove only 0.009 inch of stock to correct the inaccuracies. Within thirty-five minutes, the honing and lapping machine had refinished the cylinder to within 0.00025 inch of the specified size from end to end.

Colt-Noark Magnetic Motor-Starting Switches

Two styles of Colt-Noark Type MS magnetic motor-starting switches recently added to the line of starting switches made by the Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.,

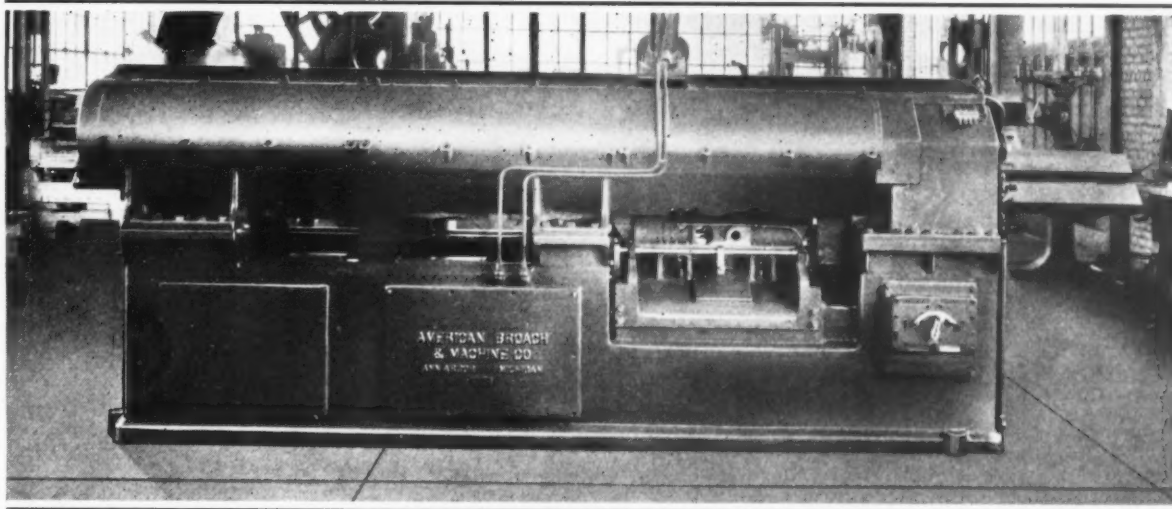


Fig. 1. Machine Designed for Automatically Broaching Locating Surfaces on V-8 Cylinder Blocks

are available for 25-, 50-, and 60-cycle alternating-current motors in the standard voltage ratings. The "local" control style is made in sizes up to and including 7 1/2 horsepower, and the "remote" control is made in two sizes, one up to and including 7 1/2 horse-

power, and the other up to and including 25 horsepower. The motor is protected from injury by accurately calibrated thermal relay heaters reacting on a bi-metallic thermostat which trips the switch when the motor is under a sustained overload.

ture as mentioned, pulling rams are actuated to carry the broaches over the cylinder. Upon the completion of the cut, the cylinder block is released from the fixture and the broaches then return to their starting position. As the cycle of the machine is repeated, the cylinder block previously broached passes through the tunnel and out at the far end. The cycle time is 24 seconds per cylinder block.

The base of the machine serves as an oil reservoir for the hydraulic system, and has a capacity of 60 gallons. The main pressure pumps, of which there

Automatic Cylinder-Block Broaching Machine

Eight locating surfaces on top of V-8 cylinder blocks are broached simultaneously in a machine recently built by the American Broach & Machine Co., Ann Arbor, Mich. This is the first operation performed on the casting. The broached surfaces are approximately 1 1/8 inches square.

The cylinder blocks are carried to this machine by a conveyor and then moved by a hydraulically operated swinging arm into the fixture. The blocks are automatically centered and lifted against locators which fit into four cylinder bores, two at each end of the block.

The machine is equipped with two hydraulic cylinders which operate in slides above the work, thus making a tunnel construction. The two hydraulic cylinders are locked together by means of a cross-head so that they move as a single unit. The upper members of the machine are made with 45-degree angular surfaces, and on each of these

surfaces are two slides which are fitted with tool-steel broach-carriers approximately 90 inches long.

Immediately after a cylinder block has been located in the fix-

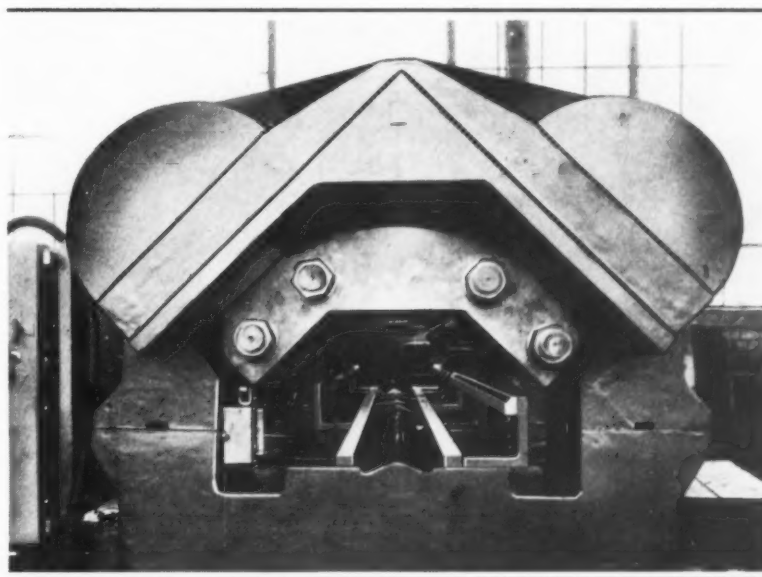


Fig. 2. Discharge End of the Cylinder-block Broaching Machine

are two, are direct-driven by motors mounted on the rear of the machine.

This machine can also be ar-

ranged for broaching the manifold surfaces, main bearing seats, and top surfaces of cylinder blocks.

Packer Applicator for Automatically Feeding Composition to Buffing Wheels

To eliminate the necessity for applying composition to buffing wheels by hand and to insure more economical and uniform application of the composition, the Packer Machine Co., Meriden, Conn., has brought out the automatic applicator here illustrated. This equipment is designed particularly for use on the automatic buffing machines of this company's manufacture, but it can be applied to other buffing machines by simply providing a suitable mounting bracket.

The maximum size of compound in cake form used in the applicator is 6 inches wide, 1 1/2 inches thick, and 11 inches long, but the holding jaws can be adjusted to accommodate cakes of smaller size.

Air pressure of not more than 60 pounds per square inch is employed to operate the equipment.

The pressure is controlled by a reducing valve. The amount of composition applied to the wheel can be adjusted to suit requirements.

Parker-Kalon Cold-Forged Cap Nuts

A complete line of cap and acorn nuts produced by a new cold-forging process which is said to give a much stronger nut has been placed on the market by the Parker-Kalon Corporation, 202 Varick St., New York City. These nuts are die-formed to uniform shape and have a finish that is free from tool marks and sufficiently smooth to eliminate the need for polishing before plating, or buffing after plating.

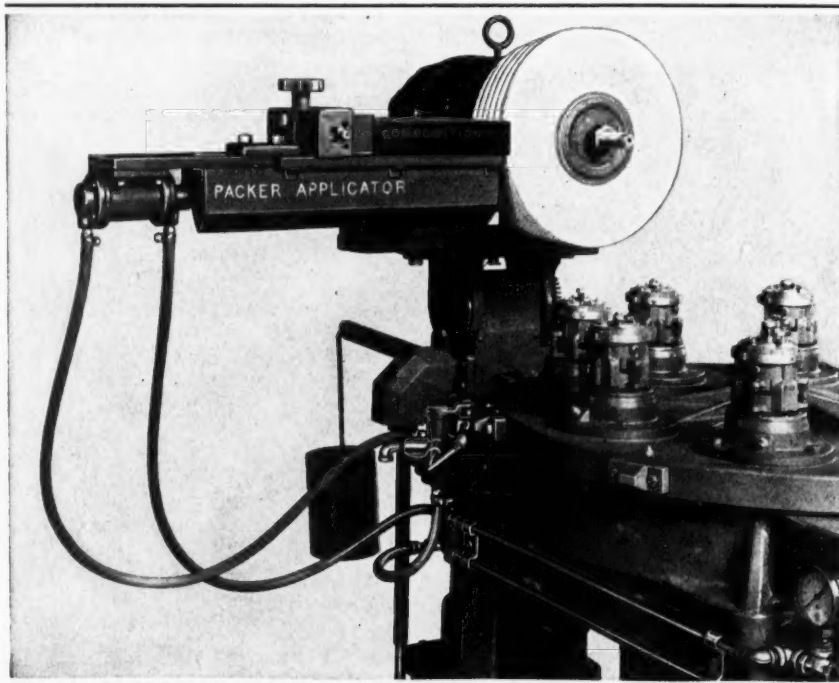
The holes are countersunk before the tapping operations, which are held to close tolerances. The

nuts are faced and their corners chamfered to permit them to be seated flush on highly finished surfaces without danger of marring the finish. Seven blank sizes are available, with standard screw thread sizes from No. 6 to 5/8 inch in the stock finish of natural brass. Plated finishes can be furnished to order, as well as nuts of aluminum and copper, with standard or special threads.

Swivel-Table Setting Equipment for Accurate Taper Grinding

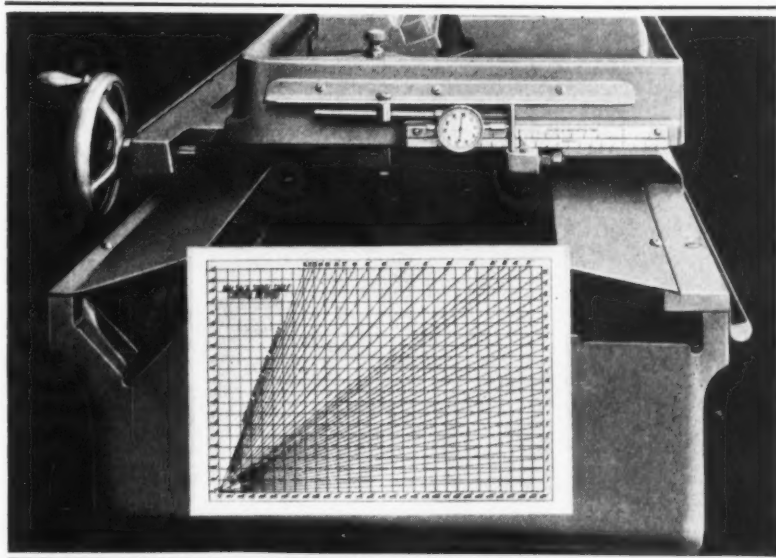
A development known as the "Malsack Grinder Control" has been announced by the Systematic Co., 709 S. 36th St., Milwaukee, Wis. This equipment is intended for application to any plain or universal swivel-table grinder used for taper and cylindrical grinding. It is particularly adapted for tool-room work where many different tapers are ground or where the set-up is changed frequently. In setting the grinding table for taper work and also in aligning it for straight work by means of the coarse scale found at the end of all grinders of this kind, it is necessary to take a trial cut and then measure the work to ascertain the accuracy of the setting. This is simply a "trial and error" method and often requires a number of cuts and measurements, all of which requires time and reduces the output.

With the Malsack control, the usual coarse scale is supplemented by a dial indicator reading in thousandths of an inch. This indicator is located at the end of the swivel table, adjacent to the scale, as shown in the illustration. A chart like the one shown is supplied for each grinder, which enables the necessary adjustment to be made quickly and accurately. With this equipment, it is only necessary to take a



Packer Composition Applicator Attached to Rotary Buffing Machine

SHOP EQUIPMENT SECTION



Grinder Equipped with "Malsack Control" to Permit Quick and Accurate Setting of Table to Required Angle

preliminary cut and two measurements, one at each end of the work, then refer to the chart and swing the table as many

thousandths of an inch as shown by the chart, the table movement being readily gaged by the indicator.

Walker Swiveling Magnetic Chuck

A magnetic chuck that can be rotated 90 degrees on a horizontal axis for retruing the top face of the chuck, positioned at intermediate angles for grinding bevels on machine knives, or rotated through 20 degrees in the opposite direction has been developed by the O. S. Walker Co., Inc., Worcester, Mass. Both faces of this chuck have T-slots for use in locating or clamping the work. The magnetic surface on the front face of the chuck is 7 1/4 inches wide, and that on the top face, 6 3/4 inches wide. The magnetic field is uninterrupted over the edge of the chuck and extends across the front and top faces for the entire width of 14 inches.

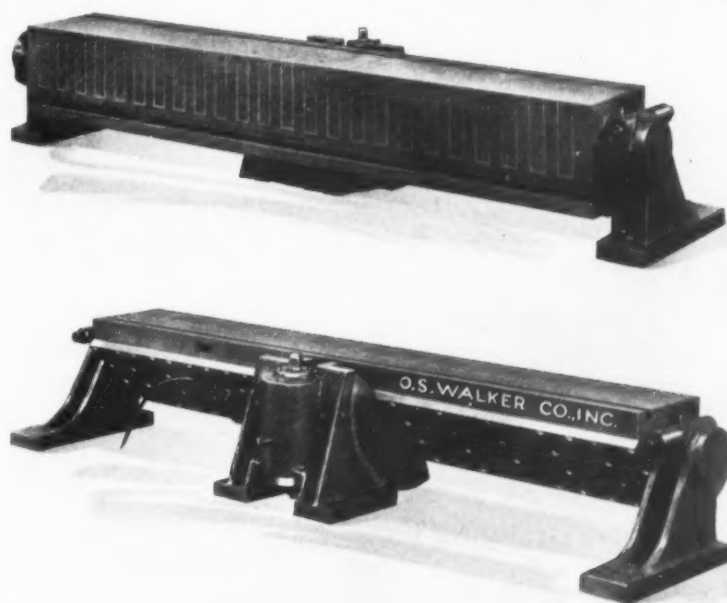
The chuck is of all-steel construction, except for the bearings and the central control unit. It is rotated by a handwheel (not shown) that is applied to a vertical shaft carrying a steel worm which engages a bronze ring gear. This control unit is protected from water and grit by a canvas guard attached to

the back of the chuck. Two clamping bolts in the control unit are used to lock the central

portion of the chuck solidly in its supporting member when correct settings of the chuck have been obtained.

The coils of this chuck are spaced on 6 1/4-inch centers, and consequently, the chuck can be supplied only in lengths varying by the same amount. Chucks can be built in single units up to 10 feet long, but above 10 feet they are made in three units with a center section 77 inches long. The end sections are welded to the center section, a continuous back plate providing an unbroken magnetic surface for the entire chuck length. Patterns are available for making chucks of this kind with a magnetic surface up to 17 feet 2 inches long when desired.

This type of chuck is suitable for all makes of face grinders used in factories producing machine knives, plain shear blades, flying shear blades, etc., and also in rolling mills and other industrial plants. It possesses the advantage of holding work uniformly along the edge for beveling operations, which is a particularly desirable feature when thin knives are being ground. The chuck can also be made in a non-rotating model.



Front and Rear Views of the Walker Swiveling Type Magnetic Chuck

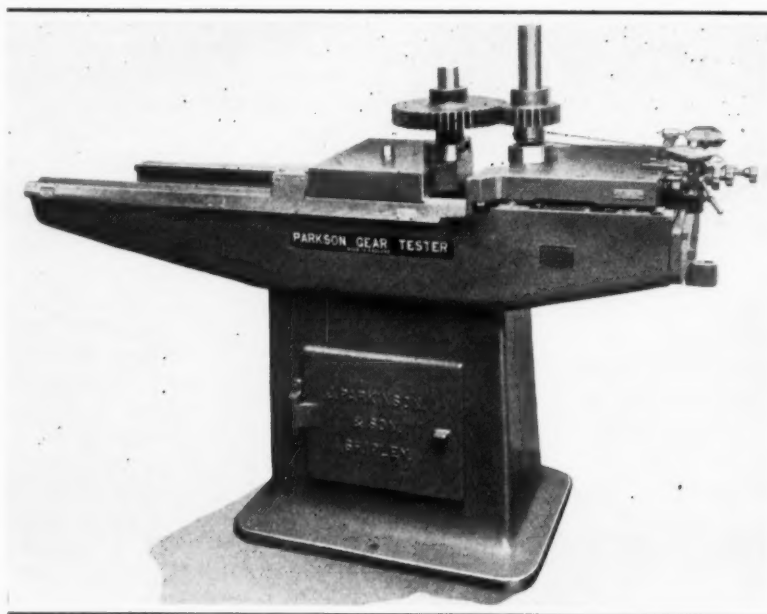


Fig. 1. Parkson Improved Gear Tester Equipped for Testing Spur Gears

Parkson Gear Tester and Fixtures

An improved model of the Parkson gear tester and fixture described on page 503 in April, 1934, *MACHINERY*, is being introduced on the market by George Scherr Co., Inc., 128 Lafayette St., New York City. This new model is made in 24- and 36-inch sizes and is adapted for testing spur, bevel, spiral, and worm gears. Compared with the earlier design, the bed is wider, deeper, and capable of supporting heavier weights without deflection. Both the floating and the adjustable carriages of

the new model are machined to the same level on their upper surfaces to receive the special fixtures used for testing spiral, bevel, and worm gears. When ordered with the tester, these fixtures are fitted so that the scale and vernier will read correctly for each fixture.

Fig. 1 shows the tester equipped for testing spur gears. The improved fixtures for testing other types of gears are shown in Figs. 2, 3, and 4. The gear tester is designed to quickly locate errors in center distance, eccentricity,

tooth thickness, and rolling action. Gears that are to be run together can be tested or, as is usually the case, the gear to be tested can be run in mesh with a master gear which is known to be accurate. Master gears hardened and ground within an accuracy of from 0.0002 to 0.0005 inch can be supplied.

The gear to be tested and the master gear, or a pair of gears, as the case may be, are mounted on stationary arbors on which they can revolve freely. One arbor is attached to the carriage that is clamped to the bed of the fixture, and the other is mounted on a carriage that has a longitudinal floating movement. When the gears are rotated, slight movements are imparted to the floating carriage by inaccuracies in the gear teeth. The extent of these movements, as shown by the dial indicator or the recording device, determines the inaccuracy of the gears.

When the recording device is used, a stylus traces a line on a circular chart, which shows any irregularities in the gears, thus providing, in graphic form, a permanent record of the character of the gear tested. The circular charts are so treated that a very fine red line is produced by the metal stylus, no ink being required. The recording device, however, cannot be used for spiral gears, worms, or worm-wheels.

In addition to the spur gear testing fixture shown in Fig. 1,

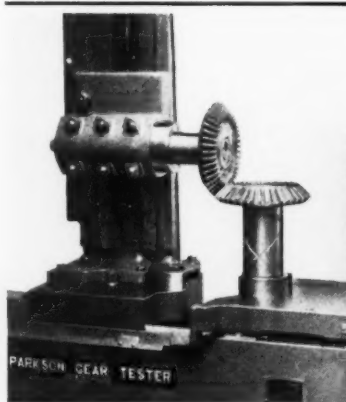


Fig. 2. Testing Bevel Gears on Parkson Gear Tester

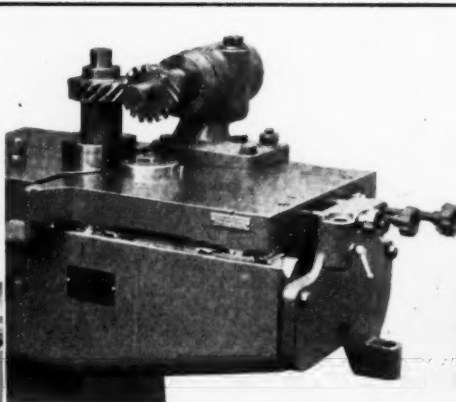


Fig. 3. Gear Tester Equipped for Testing Spiral Gears

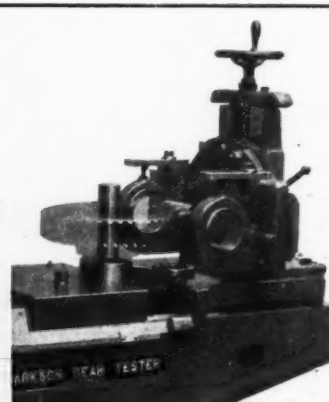


Fig. 4. Worm-gear Testing Fixture on Parkson Tester

SHOP EQUIPMENT SECTION

there is a "high center" attachment for testing gears up to 11 inches in diameter with shafts 18 inches long between centers.

In the equipment for bevel gears, shown in Fig. 2, the gear on the vertical arbor is carried by the floating carriage, while the gear on the horizontal arbor is carried on a saddle that is adjusted by a screw on a vertical slide. The horizontal distance from the face of the socket that carries the horizontal arbor to the axis of the wheel on the vertical arbor can be read from the

pair does not exceed 8 inches in diameter. The worm-wheel is mounted on the vertical arbor on the adjustable carriage and the worm is carried in bearings or between centers on the floating carriage. The relative positions of the worm and worm-wheel are shown by the phantom views. The distance between the worm and worm-wheel can be varied, and the slide has an angular adjustment of several degrees for obtaining the best position for the contact of the worm threads with the worm-wheel teeth.

be supplied for use on soft tubing, so as to prevent scratching. Stops can be set at any angle within an arc of 180 degrees.

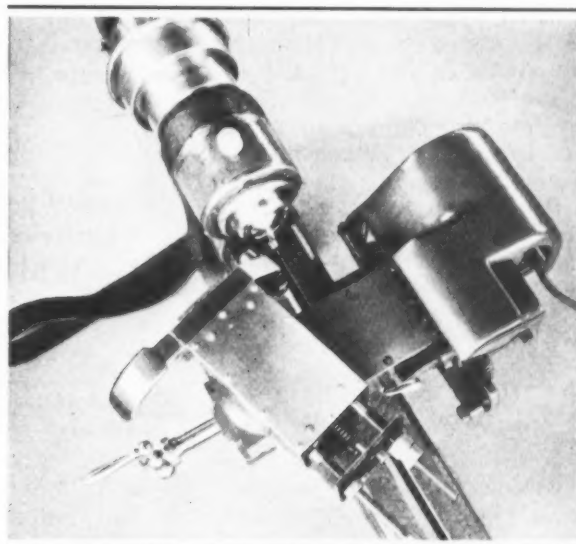
When extra heavy bending is to be performed, a gear and ratchet are provided.

Rivett Automatic Slide-Rest with Motor Drive

A slide-rest with an independent motor drive and change-gear unit for obtaining a wide



Hand-operated Equipment for Bending Bars and Tubes up to 2 Inches in Diameter



Rivett Automatic Motor-driven Slide-rest in Position for Starting a Cut

scale and vernier, and the vertical distance from the face of the boss of one gear to the axis of the other can also be read from the scale and vernier on the vertical slide.

The equipment for testing spiral gears, shown in Fig. 3, will accommodate pinions up to 8 inches in diameter, and spiral gears of any size can be readily tested, the only restriction being that the size of the gear be such that the distance between centers is not more than 24 inches on the smaller size tester, nor more than 36 inches on the larger size.

The equipment for testing worm-gears, shown in Fig. 4, can also be used for spiral gears, provided the smaller gear of the

Williams-White Hand Tube- and Bar-Bender

A hand-operated machine designed for bending bars and tubing up to 2 inches outside diameter is shown in the accompanying illustration. This machine is a recent development of Williams, White & Co., Moline, Ill. Tubes and bars can be bent to a maximum radius of 8 inches.

Material can be bent either right- or left-hand. One set of dies and an arbor pull are provided. The dies are of such a design that they can be made on an engine lathe, shaper, or drilling machine. Dies can be furnished made of various materials to suit the work being bent. For instance, a brass wiper die can

range of feeds has been developed by Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass., for use on that company's precision bench lathes. This equipment is designed to give high production rates on small parts that require a very fine finish. Either tungsten-carbide or diamond tools are used at speeds of 3300 or 4600 revolutions per minute. The machining of 1/4-inch brass carburetor needle points to an included angle of 60 degrees at the rate of 300 pieces an hour is typical of the work performed.

The automatic slide-rest is easily mounted on the compound slide-rest shoe of the lathe. An electrical cord with a starting and stopping switch connects the

SHOP EQUIPMENT SECTION

single-phase, 110-volt, alternating-current, 1/20-horsepower motor with the lighting circuit. The slide on which the tool is mounted has a graduated dial and can be set parallel with the lathe spindle or swiveled to any angle up to 90 degrees. The maximum tool travel is 3 inches.

Pick-off gears give a wide range of feeds for the tool-slide. The spindle speed can be changed without affecting the feeding speed, making possible a wide range of feeds per revolution. Automatic stops are provided for controlling the length of feed of the slide. In taking a cut, the operator simply starts the motor of the slide-rest and depresses the handle on the left-hand end of the slide, causing the tool to rise into the cutting position and feed to the left. When the tool reaches the stop set for the end of the cut, it automatically drops away from the work and the slide returns to the starting position.

Robertson Improved Power Hacksaw

A feature of the No. 2 Economy power hacksaw, recently brought out by the W. Robertson Machine & Foundry Co., 56-58 Rano St., Buffalo, N. Y., is provision for automatically stopping the motor, as well as the

saw frame, when the saw has completed the cut. Another feature is the completely enclosed worm-gears, which run in an oil bath. The electric motor is connected to the worm-shaft through a flexible coupling to provide quiet operation. Two sizes of worm-gears are available, which adapt the machine for operation by electric currents of all frequencies.

This machine has a cutting capacity of 6 by 6 inches with a 6-inch stroke, and takes blades from 12 to 14 inches in length. The vise can be swiveled to 45 degrees for taking angular cuts. A hydraulic lift serves to relieve the blade teeth of all back drag and positively prevents the frame from falling on the work.

Polishing and Buffing Lathe with Extra Wide Swing

A buffing and polishing machine having an extra wide swing, as shown in the illustration, is being placed on the market by the Standard Electrical Tool Co., 1928 W. 8th St., Cincinnati, Ohio, as a supplement to the line of variable-speed buffing and polishing machines of 3, 5, and 7 1/2 horsepower sizes made by this company. The new machine can be furnished

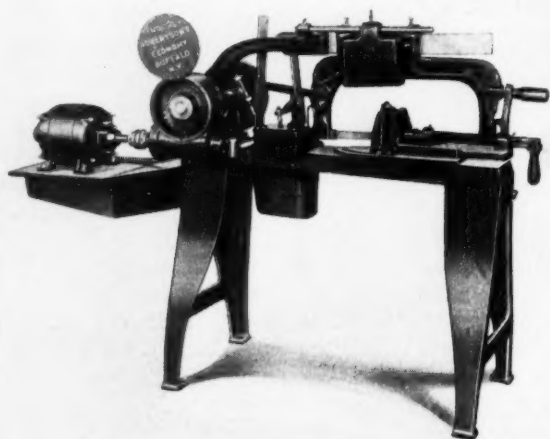
with a 10- or 15-horsepower ball-bearing motor.

The over-all length of the spindle is 108 inches, and the distance between the base and the inside of the wheels is 29 inches. This provides ample room for finishing unusually large parts. The motor is mounted on a hinged bedplate inside the base. A hand-adjusting screw provides means for raising and lowering the motor for adjusting the tension on the driving belts. Power is transmitted from the motor to the spindle by a V-belt drive. The entire spindle assembly can be removed without disturbing the bearing mountings. Thus but a few minutes is required for the removal of belts.

A hand-brake at the front of the machine also actuates the motor control switch, disconnecting the motor when the brake lever is pulled forward to apply the brake. When the hand-brake lever is moved to the rear, the brake is released and the circuit opened.

Meter for Obtaining Total Running or Idle Time

For obtaining the total running or idle time of electrically operated machinery, including machine tools, welders, electric signs, refrigerators, radio trans-

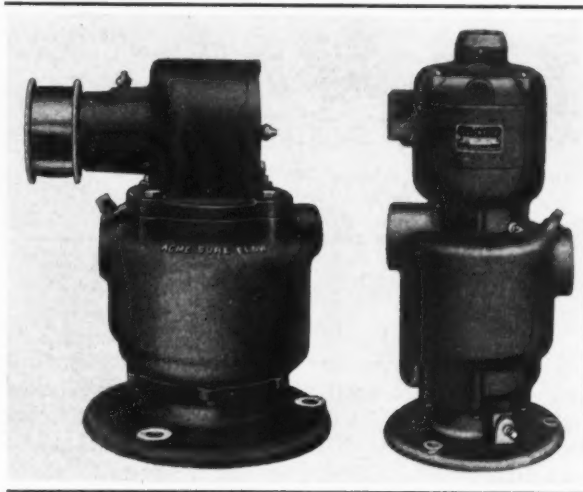


Robertson Power Hacksaw with Automatic Stop for the Frame and the Motor



Standard Electrical Tool Co.'s Extra Wide Swing Polishing and Buffing Lathe

SHOP EQUIPMENT SECTION



Belt- and Motor-driven Models of Acme
"Sure Flow" Pumps



Hoffmann Metal-marking Machines Made
by the Quality Die Co.

mitters, or any individual alternating-current powered unit, the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has developed the "Total Time" meter. This meter gives the total number of hours an electric circuit is closed or in operation. The registering mechanism has four dials and will register 9999 hours before repeating. If desired, the meter can be mounted in an office and connected to a machine by a single pair of wires.

Acme "Sure Flow" Pumps

The new line of "Sure Flow" pumps introduced by the Acme Machine Products Co., Inc., Muncie, Ind., is available in belt-driven models having capacities of 4, 10, 20, 50, and 100 gallons per minute, and in direct motor-driven models having capacities of 10, 20, 50, and 100 gallons per minute. All models are manufactured for both low-pressure and high-pressure duty. Either horizontal or vertical bases can be supplied.

These pumps are designed to handle coolants, water, oils, or fluids even though they are full of abrasives, and they can be used for any general industrial application requiring the transfer of liquids.

The new pumps are designed to maintain their priming with-

out submerging part of the pump in the fluid to be pumped. They can be installed in any convenient location on a machine tool. A single line of pipe is run to the fluid reservoir.

Hoffmann Self-Contained Metal-Marking Machines

Two types of machines for marking or stamping names or numbers on metal and metal products have been brought out by the Quality Die Co., 93rd and Baltimore Ave., South Chicago, Ill. One machine contains all the letters of the alphabet and the numerical digits from 1 to 0 on a single wheel, as shown in the illustration. A single character is impressed at a time, but any combination of figures and letters can be stamped by turning the wheel to the required positions. Accuracy in stamping is secured by a guide opening in the face of the machine, through which appears a duplicate of the character to be impressed. Grooves in the base of the machine serve as guides for placing and aligning the characters on the surface to be stamped.

The second machine, with the multiple wheel, can be supplied with any number of wheels from two to nine. Each wheel contains ten, twelve, or fourteen characters, either figures or letters, or a combination of both,

as desired. By turning the wheels, the characters, as they are to be impressed, can be arranged in a single straight line in any combination. Special characters can be engraved to order. Both machines are made of specially hardened and tempered tool steel and are guaranteed to impress metals up to and including Brinell hardness No. 415. They can, of course, be used in marking fiber, leather, wood, or any material that requires identification numbers or letters.

Campbell Bar Stock Floor Stands for Cutting-Off Machines

The Andrew C. Campbell Division of the American Chain Co., Inc., Bridgeport, Conn., has brought out a bar stock floor stand for use with the company's Models 202 and 203 wet abrasive cut-off machines and the Model 20 dry abrasive cut-off machine.

These stands have a self-adjusting feature, and when once set for height, any shape or size of stock that the machine will handle is supported at the correct height for the machine. Although designed for use with the machines referred to, these floor stands can be used to advantage wherever bar stock or tubing must be supported.

Yale "Pul-Lift" Hoisting and Pulling Device

The "Pul-Lift" device here illustrated is a recent development of the Yale & Towne Mfg. Co., Philadelphia, Pa. The name "Pul-Lift" is derived from the fact that this device is designed and built for use in either a horizontal or vertical position; that is, it can be used for both pulling and lifting. It is made in four sizes having lifting capacities of $3/4$, $1\ 1/2$, 3, and 6 tons. Heat-treated chrome-nickel steel gears, sprockets, and load brake parts are used to obtain light weight. The device is employed in the horizontal position for stretching cables, pulling in boiler tubes, pulling machines into position, placing stone or marble blocks in position on polishing machines, and many similar purposes. It is used vertically as a hoist for lifting all types of loads within the rated capacities.



"Pul-Lift" Device Made by the Yale & Towne Mfg. Co.

A Weston type, self-actuating load brake is employed, which is designed to hold the load firmly at all times. A ratchet and pawl lifting mechanism is used on the smaller sizes, and gear reduction units on the larger sizes. The operating handle can be used in any position desired. The load hooks serve as safety devices, since they are designed to open up before any vital parts are overtaxed. The moving parts are completely enclosed and may be operated in grease.

"shoot" the metal into the dies until they are securely locked. An electric safety mechanism, as well as a pilot valve mechanism, eliminates any chance of "shooting" the metal when the dies are open.

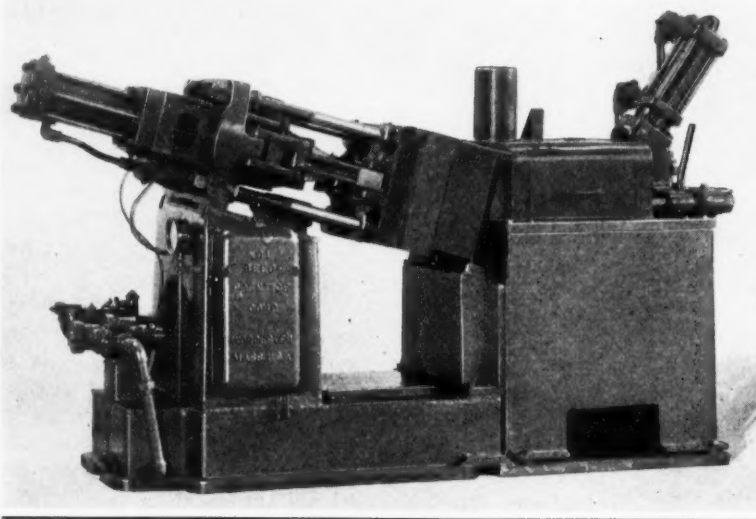
When the dies are constructed for automatic ejection, the castings are ejected through holes in the center of the die plate as the dies open. This permits the castings to drop into a box or chute at the bottom of the die from which they can be removed automatically. The die plates are planed on four sides for the application of core-pulling attachments. The removable die plate is bronze-bushed and has oiling facilities.

This machine is made in three sizes with pressure capacities of 4900, 11,000, and 16,000 pounds, and strokes of 6, 8, and 10 inches. The smallest or No. 1 size has die plates 18 by 20 inches and a capacity range of 1.75 to 7 pounds per "shot" of zinc die-casting metal. The No. 2 size has die plates 30 by 32 inches and a range of 6 to 21 pounds of metal per "shot." The No. 3 size has die plates $34\ 1/2$ by $38\ 1/2$ inches and a range of $11\ 3/4$ to 38 pounds of metal per "shot." The machines are driven by 5-, $7\ 1/2$ -, and 10-horsepower motors.

Reed-Prentice Die-Casting Machine

A fully automatic type, hydraulically operated die-casting machine with an electric timing mechanism which allows the operator to set the machine for any predetermined period from 0 to 20 seconds for the solidifying of castings, has been an-

nounced by the Reed-Prentice Corporation, Worcester, Mass. This machine can be arranged for automatic or manual operation, separate control levers being provided for this purpose. The design of the machine is such that it is impossible to



Reed-Prentice Full Hydraulic Die-casting Machine

Purox General-Duty Welding Torch

The Purox No. 35 general-duty welding torch, which has just been placed on the market by the Linde Air Products Co., 30 E. 42nd St., New York City, embodies various refinements in mechanical details. It is con-

SHOP EQUIPMENT SECTION

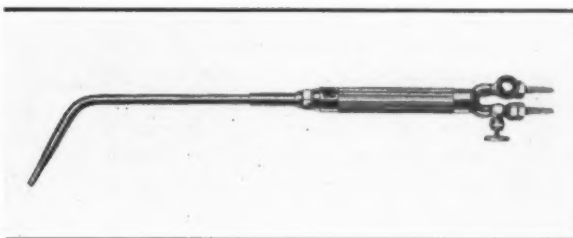
structed of extruded brass and Monel metal, drawn copper, and silver soldered tubes. It is claimed to be equally adapted to the lightest as well as the heaviest work ordinarily encountered in any welding shop.

The head is designed to offer maximum resistance to flash-back and at the same time, give a wide range of effectiveness for each size tip, nine tips performing the work for which fifteen tips are usually required. The welding head is so designed that it can be assembled in six different positions relative to the body of the torch. The standard Purox No. 21 cutting attachment can be used with this torch.

Hisey Motor-Driven Drill Grinders

The Hisey floor-stand motor-driven drill grinder, recently brought out by the Hisey-Wolf Machine Co., Cincinnati, Ohio, is designed for sharpening straight or tapered shank drills having two, three, or four lips, and flat or chucking drills; also flat twist drills and drills with over-size shanks. This machine can be adjusted for clearance and point angle.

One cup-shaped grinding wheel and one wheel for point thin-



Purox No. 35 Welding Torch Developed by the Linde Air Products Co.

ning are regularly supplied. The latter wheel can be replaced by a straight-faced wheel for tool grinding in connection with the tool-rest furnished as standard equipment for the left-hand end of the machine. This machine is made in two sizes for direct and alternating current. One size handles drills ranging from No. 52 to 1 1/4 inches in diameter, and the other machine handles drills from 1/8 inch to 2 1/2 inches in diameter.

"Hi-Lo" Variable-Speed Pulley

A variable-speed sheave or pulley that automatically regulates the belt tension to suit the load has been brought out by the Equipment Engineering Co., 727 Fourth St., South, Minneapolis, Minn. This pulley gives a variable speed with constant-speed motors and standard V-belts, and will maintain a constant speed at any set point, re-

gardless of variations in the load. The pulley is made with two telescoping pulley faces mounted on a sleeve which operates freely on a spindle. The faces are held together by light springs. These springs are not driving members, but serve only to keep the faces in contact with the

belt at all times.

When the motor starts, the belt picks up the free pulley faces and moves them against the cams on each side, causing the faces to come together. As the angle of the cams corresponds to the pitch of the pulley faces, any pressure of the belt transmitted through the pulley face to the cams is transmitted at right angles, and consequently there is no tendency for the pulley faces to move in either direction after coming in contact with the cams. As the load begins to drop after starting, the tension eases, so that at no time is the belt tension greater than that required to drive the load. This feature relieves the belt of unnecessary strain and tends to prolong its life.

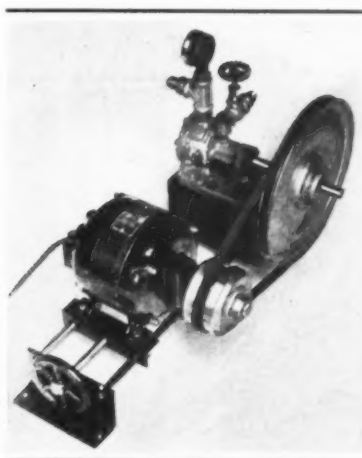
This pulley can be adjusted to give an infinite number of speeds within its range, and can be set while in operation or while the motor is stopped.

Kent-Owens Milling Machine with Cam-Controlled Feed

A No. 26 milling machine with a cam-controlled table feed which permits any desired cycle of automatic table movements to be obtained has been announced by the Kent-Owens Machine Co., Toledo, Ohio. This machine is especially designed for high-production jobs and long runs requiring economical operation. A cushioned belt drive to the spindle is employed to assure smooth cutting and eliminate backlash. Spindle speeds up to 2000 revolutions per minute are obtainable with standard equip-



Hisey-Wolf Motor-driven Drill Grinder



Application of "Hi-Lo" Variable-speed Pulley

SHOP EQUIPMENT SECTION

ment, but provision can be made for higher speeds.

Special cutter arrangements and automatic fixtures can be employed. A table working surface of 36 by 8 1/4 inches, with three T-slots, permits the mounting of two fixtures, one of which can be unloaded and loaded while the other is under the cutter. Pick-off gears in the table feed train permit the cam drum speed to be easily changed. The cam drive gears, cam, and clutch operate in an oil bath. The cam housing is cast integral with the saddle and is mounted on the machine knee.

A multiple-plate clutch designed to insure smooth engagement and instantaneous release is incorporated in the machine. The cam can be disengaged at any time and the machine operated through its complete cycle by hand.

"Alligator" Belt Cutter for Squaring Belt Ends

A tool for cutting off flat belts employing a new principle in mechanical belt cutting has been developed and patented by the Flexible Steel Lacing Co., 4607-31 Lexington St., Chicago, Ill. The cut is made by pushing the knife through the belt from one edge to the other. The knife is mounted on a plunger in a slot, as illustrated, and is operated by a direct push without mechanical leverage. This tool is used either horizontally on the

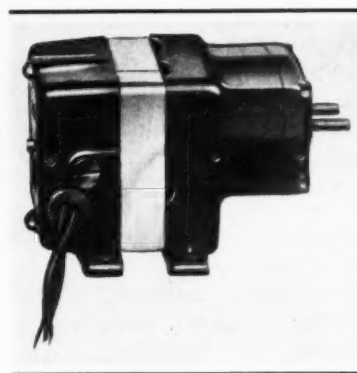
bench as shown, or in a vertical position on the floor.

The knife cuts through most belting very easily, and will cut even the thickest and toughest belts up to 8 inches in width with little effort. The knife, of special alloy steel, will make several thousand cuts and is easily replaceable. The belt is held immovable by the equalizing clamp while the cut is being made. The clamp also serves as a guard for the blade. The clamp and frame are of aluminum and the weight of the complete tool is only 4 pounds 3 ounces.

Speedway "Flea Power" Motors

A new series of 110-volt, induction and series wound, back-gear motors has been added to the line of "Flea Power" motors made by the Speedway Mfg. Co., 1834 S. 52nd Ave., Cicero, Ill. These motors, which measure less than 3 by 3 by 3 1/2 inches, with built-in speed reducers, differ from the skeleton motors of the company's line in that they are encased by cast-steel end-bells, the induction types being air-cooled by a small rotary blower.

The built-in gear-box permits innumerable speed combinations for the two shafts, which may have different speeds. The motor is provided with feet to facilitate mounting in either the horizontal or vertical position. Ample oil reservoirs for long

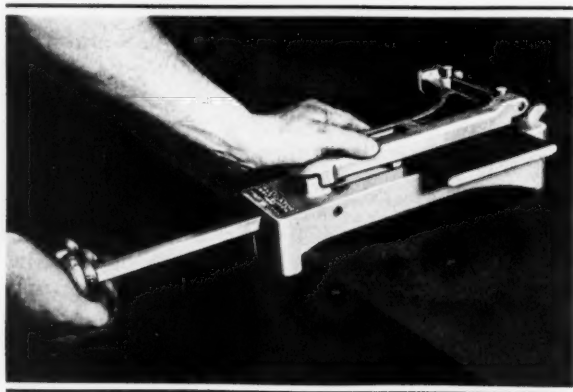


"Flea Power" Motor Made by the Speedway Mfg. Co.

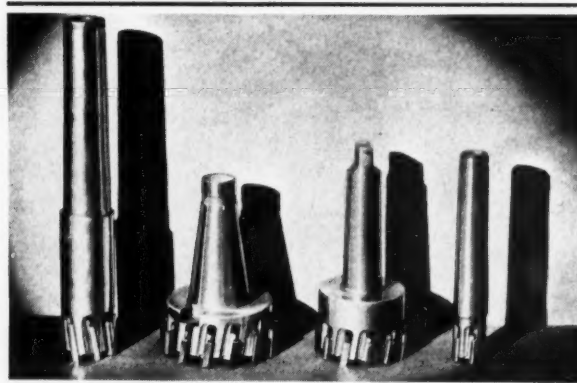
continuous operation are provided. The Type No. 910 motor operates on 110 volts direct current only, and has an output of 10 watts. The Type No. 911 operates on both alternating current and direct current, and has an output of 15 watts.

Ingersoll "Zee-Lock" End-Mills

The Ingersoll "Zee-Lock" cutter blade, designed especially by the Ingersoll Milling Machine Co., Rockford, Ill., for the face mills made by that company has now been applied to inserted-blade end-mills. The blade is positively locked in the cutter body by a Z-shaped wedge, which, in addition to locking the blade, permits it to be adjusted automatically in two directions. Most of the adjustment is outward on the diameter, but a



"Alligator" Belt Cutter Made by the Flexible Steel Lacing Co.



End Milling Cutters Equipped with Ingersoll "Zee-Lock" Cutter Blades

SHOP EQUIPMENT SECTION

slight amount of adjustment can be made along the face. It is applied to small end-mills as shown in the illustration.

The removable cutter blades of forged heat-treated chrome-molybdenum steel have hard, heat-resisting cutting material only on their edges. This cutting material may be either high-speed steel, super-cobalt high-speed steel, J-metal, or cemented carbide. Milling cutters as small as 1 1/2 inches in diameter are made, and cutters are furnished with blades of suitable thickness or spacing for either roughing or finishing operations. They can be provided with shanks to fit the National Standard milling machines, Ingersoll, or Seller tapers, etc. Cutter housings with an extended body for special operations are obtainable.

Extension Link for Landis Collapsible Taps

For tapping threads that are too long to be machined with standard taps, the Landis Machine Co., Inc., Waynesboro, Pa., has designed a special link for use between the body and the head of the Style LT collapsible taps and the Style LM receding-chaser collapsible taps. This construction is possible because the heads of these taps are made detachable from the body in order to permit several heads of different sizes to be used on the same body.

The extension link is machined on one end and drilled and tapped

to fit the tapped body, while the opposite end is made to fit the tapped head. This permits using a standard body and a standard head, thus eliminating the necessity for making special parts. Any length of link can be provided to suit the length of thread to be cut.

Niagara Sleeve Clutch for Power Presses

Fourteen engaging jaws designed to distribute the load over a contacting surface having many times the usual area are employed to prolong the life and provide instant engagement of the sleeve clutch recently brought out by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y., for use on power presses. When the sleeve is engaged, driving energy is transmitted to the crankshaft by twenty-six internal splines on the inside of the clutch sleeve bore. These splines are in constant mesh with the corresponding external splines on the crankshaft. The crankshaft can be arranged to stop before or after the top center position by mounting the clutch sleeve in the corresponding radial position.

When the treadle is depressed, a large concentric spring slides the clutch sleeve into engagement. At the end of the stroke, the sleeve is withdrawn by a cam race machined in the sleeve, which is engaged by a hardened alloy steel follower spindle mounted in long anti-friction

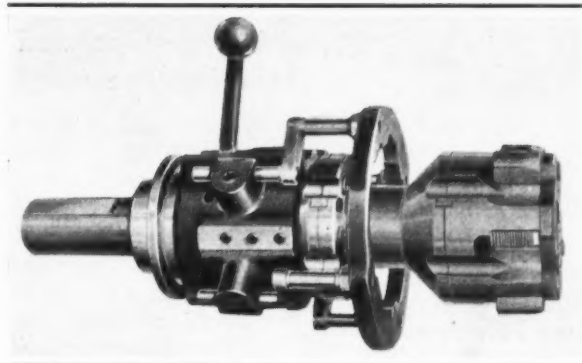


Niagara Fourteen-point Engagement Clutch for Presses

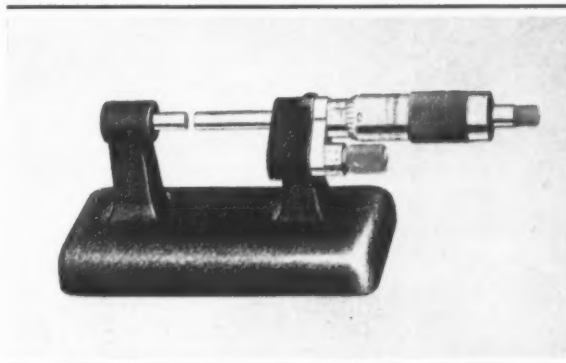
bearings. A positive locking device is built into the throw-out mechanism to prevent accidental engagement of the clutch when setting the dies. The clutch may be locked or released while the flywheel is rotating by simply turning a conveniently located handle. A single-stroke, non-repeat device is a feature of the sleeve clutch which prevents a second stroke of the slide, even if the treadle is held down. Thus the treadle must be raised and depressed again for a second stroke. This single-stroke device can be disconnected if desired, so that the clutch will remain in engagement as long as the treadle is depressed.

Brown & Sharpe Bench Micrometer

A bench micrometer caliper—No. 240 RS—particularly adapted for the use of inspectors,



Landis Tap Equipped with Extension Link for Tapping Long Threads



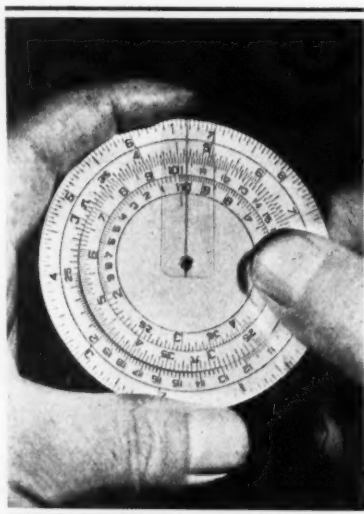
Brown & Sharpe Bench Micrometer for Accurate Measurement of Small Parts

watchmakers, manufacturing jewelers, etc., has been brought out by the Brown & Sharpe Mfg. Co., Providence, R. I. This micrometer reads to 0.0001 inch directly by an auxiliary thimble, and has a measuring range from 0 to 1 inch. Fractional parts of the 0.0001 inch graduations can be readily estimated. A ratchet stop is provided. The heavy and rigid base prevents the tool from being upset easily.

Vest-Pocket Slide-Rule

A Mascot vest-pocket slide-rule recently placed on the market by the Tavella Sales Co., 25 West Broadway, New York City, weighs less than an ounce, is only 2 3/4 inches in diameter, and yet has a multiplication-division scale 6.3 inches long. It is constructed of celluloid and is designed to withstand hard usage.

The front side has four scales, namely, the logarithm, C, D, and CI or C inverted scales. The reverse side has sine and tangent scales and an A and D scale for finding squares and square roots. Directions are included with each rule for solving problems in multiplication, division, square root, and proportion, as well as problems involving the use of logarithms and functions of angles.

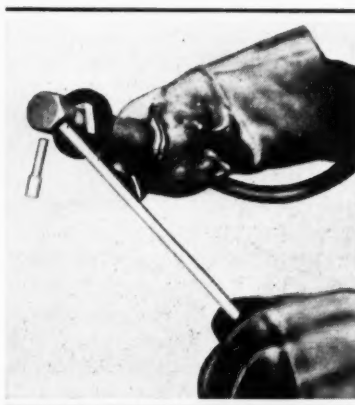


Vest-pocket Slide-rule Made of Celluloid

Metalweld Electrode-Holder

A "Navy Type" electrode-holder and "Shur Grip" clamps for the attachment of current-carrying cable to the generator and between sections of the cable have been announced by Metalweld, Inc., 26th and Hunting Park Ave., Philadelphia, Pa. This equipment is intended for general welding purposes. It has been adopted as regular equipment in the Philadelphia Navy Yard where 300 are now in use.

It is claimed that the positive contacts made by the screw-

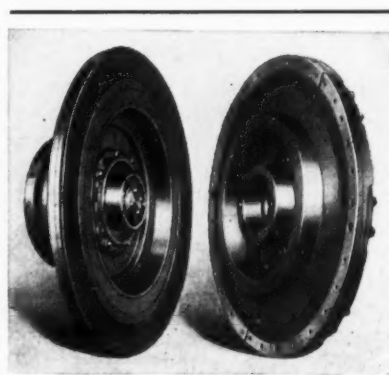


Method of Releasing Stub from Metalweld Electrode-holder

actuated clamps or connections of this equipment eliminate any chance of "porous" welds, which are frequently due to poor contacts. The fiber handle of the electrode-holder permits grasping the holder near the electrode, thus facilitating accurate control under all conditions. The electrode is held in a vise-like grip, yet a slight twist with a fresh welding rod in the manner shown in the accompanying illustration serves to release the old stub. Another twist in the opposite direction clamps the new electrode in place.

Cutler-Hammer Magnetic Clutch of Improved Design

A general-purpose magnetic clutch with a number of important improvements is an-



Magnetically Operated Clutch Developed by Cutler-Hammer, Inc.

nounced by Cutler-Hammer, Inc., 264 N. 12th St., Milwaukee, Wis. A feature of this clutch is the method of adjusting the friction faces to compensate for wear and to insure uniform lining engagement. The field ring is threaded, so that adjustment is made by rotating it with respect to the magnet field member, the thread causing the field ring to move toward the friction surface on the armature member. When the field ring has been moved forward sufficiently to compensate for wear, it is locked in position. A floating magnet armature makes it impossible to score the magnet pole faces, even if the proper adjustment of the lining is not maintained.

Other features include a magnet coil which can be readily removed and replaced as a unit; a lining wear indicator; and a pilot bearing that insures concentric engagement of the two members.

Hannifin Air-Operated Molding Press

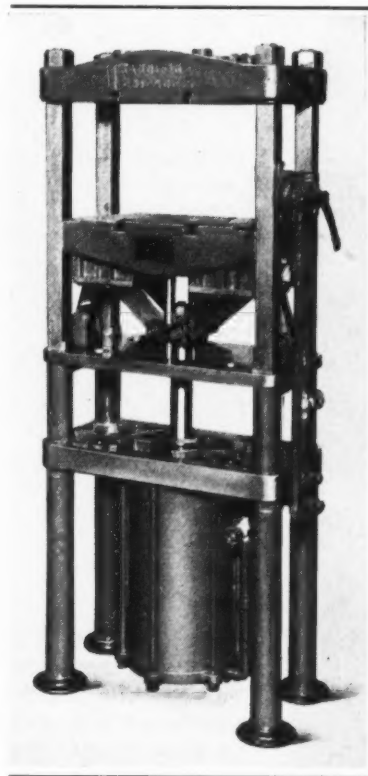
An air-operated platen type of press for plastic and rubber molding operations is being introduced on the market by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill. This press has an advance stroke six times the speed of the pressing stroke. The advance stroke is 5 1/2 inches long and is effected by a pressure of 6000 pounds, while the pressing stroke

SHOP EQUIPMENT SECTION

is 1 1/2 inches long and is effected by a 30,000-pound pressure. The cycle of operations is arranged to give rapid production. One operator can easily handle several of these molding presses.

The press can be used for both hot and cold molding, and its speeds and pressures can be regulated to suit individual requirements. A feature of particular advantage in plastic molding is that the maximum pressure can be applied for "breaking" or separating the molds on the reverse stroke after the pressing operation has been completed. An air cushion is provided which prevents shock at the end of the stroke.

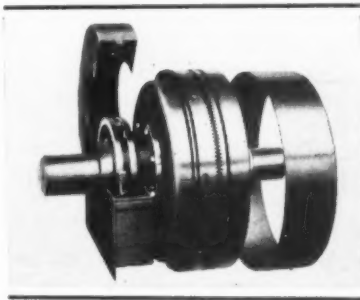
The press has a capacity of 15 tons with an air-line pressure of 80 pounds per square inch, and of 18 tons with an air-line pressure of 100 pounds per square inch. The platen measures 17 by 14 inches. The same type of press can be supplied inverted for mounting on a bench.



Hannifin Air-operated
Molding Press

Dings Magnetic Clutch Coupling

A recently patented magnetic clutch coupling designed to insure positive and quick engagement and disengagement with less than 1 1/2 degrees of slip is announced by the Dings Magnetic Separator Co., Milwaukee, Wis. This device has already found wide application on hot- and cold-strip rolling-mill shafts and in many other applications where positive engagement and remote control are necessary or desirable. Disengagement of the



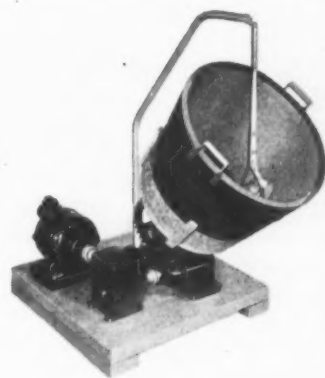
Dings Magnetic Clutch Coupling
Designed for Instant and Positive
Engagement

clutch is obtained by means of internal coil springs.

The illustration shows this Type SCC clutch with the cover plate removed to expose the bronze teeth of one clutch member which engage steel teeth in the other member. Lag due to residual magnetism is eliminated by using brass for one member of the clutch. Thus instant disengagement is obtained, the speed of operation being so rapid that "racking" of the teeth is impossible. The cover plate prevents dust and dirt from lodging on the engaging teeth. A clutch of this type 12 inches in diameter will deliver more than 1500 foot-pounds of torque.

Udylite "Handiplater" for Plating Small Parts

A small inexpensive barrel plating unit designed to handle occasional handfuls of work or



"Handiplater" Made by Udylite
Co. for Small-lot Plating

the production plating of small quantities of small parts up to 25 pounds has been brought out by the Udylite Co., 1651 E. Grand Blvd., Detroit, Mich. A detachable cylinder makes possible the use of any barrel plating solution in the same cylinder.

The unit is motor-driven by a 1/6-horsepower motor, which can be operated from a light socket. The equipment takes up little space. After plating, removal of the anode basket and solution permits the cylinder to be used for drying or tumbling.

* * *

Industry Shows Increasing Activity

The machine tool industry is reaching a new level of activity. For the first time since the beginning of the depression, the machine tool business is exceeding the average for the last fifteen years.

The American-Russian Chamber of Commerce announces that the Amtorg Trading Corporation has placed orders for machine tools and other equipment to the amount of \$4,500,000, for Soviet automobile plants.

Members of the Automobile Manufacturers Association produced over 276,000 motor vehicles in June, an increase of 11 per cent over the preceding month, and 21 per cent over the corresponding month last year.

Remarkable Service Records

The Cleveland Twist Drill Co., Cleveland, Ohio, recently announced two remarkable employe service records. F. F. Prentiss, chairman of the board of directors, and R. D. Boltey, senior Cleveland salesman, have each completed fifty-five years of service with the company. It is interesting to note that both men are still actively engaged in promoting the interests of the business.

Mr. Prentiss went to Cleveland in 1879 and there began the manufacture of locks under the firm name of Davies & Prentiss. In 1880 he became a partner of J. D. Cox, Sr., forming the firm of Cox & Prentiss, to engage in the manufacture of milling machines, planers, and twist drills. From a small building on the flats of Cleveland, employing twelve men, the business grew steadily until, today, its successor, the Cleveland Twist Drill Co., employs more than five hundred people. During this development, Mr. Prentiss successively held positions as superintendent, manager, vice-president, president, and chairman of the board.

Mr. Boltey joined the Cleveland Twist Drill Co. when a mere child. His first job consisted of brushing the flutes on drills; then cutting off steel. From this he went to what was then known as the bit stock department and when he was only fifteen, he was head of this department supervising the work of five other boys. He progressed steadily from one department to another until he had covered every operation in the factory. In 1905, Mr. Boltey joined the sales department, where he has been ever since.

* * *

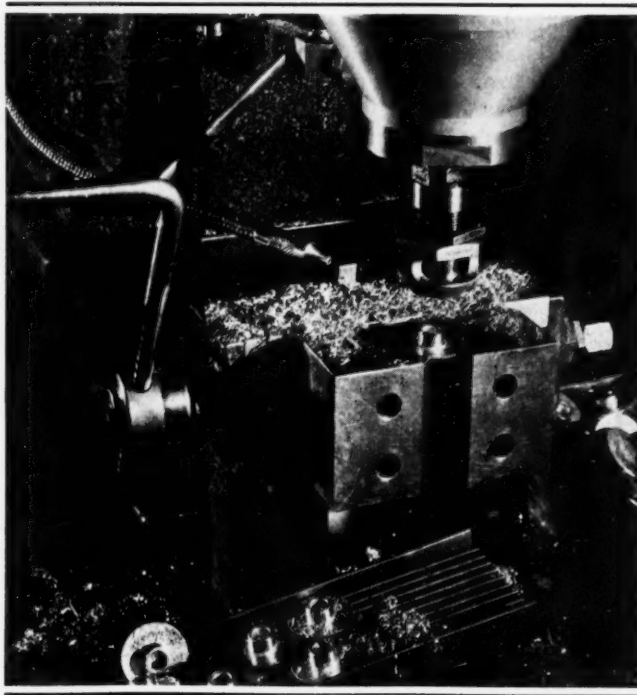
Orders received during the first six months of 1935 by the General Electric Co. amounted to \$104,543,000, as compared with \$92,154,600 for the first six months of last year, an increase of 13 per cent. The sales billed during the first six months of 1935 showed an increase of 17 per cent, as compared with the same period last year.

External Threads Cut on a High-Speed Tapper

Cutting the external threads on the small die-castings shown in the accompanying illustration was formerly done in a hand screw machine with a self-opening die-head. As the thickness of the flange on the work varied, trouble was experienced in threading up to the shoulder.

This difficulty was overcome by performing the threading operations on a high-speed tapping machine made by the R. G. Haskins Co., 4634 W. Fulton St., Chicago, Ill., which was equipped with an "Acorn" die, as shown in the illustration. The standard tapping fixture with a pair of special jaws for holding the work, as shown, made it possible to thread up to the shoulder. Any variation in the thickness of the flange causes no trouble, as the clutch merely slips when the thread is cut clear up to the flange, thus avoiding stripping the threads.

The rigid non-floating spindle of the Haskins tapping machine equipped with the free-cutting "Acorn" die, made by the Greenfield Tap & Die Corporation, Greenfield, Mass., made possible the maintenance of close tolerances and also resulted in increasing the production from 300 to 1200 pieces per hour. The speed employed in "threading on" is 875 revolutions per minute, while the speed for "threading off" is 1750 revolutions per minute.



Cutting 1/2-20 Threads, 3/8 Inch Long, on Zinc Die-castings at the Rate of 1200 an Hour

The Fallacy of Wage and Hour Controls

That continuance of governmental control over wage rates and working hours can only result in diminishing the total volume of employment, reducing the annual income of wage earners, and lowering the standard of living is graphically demonstrated in a booklet "The Fallacy of Wage and Hour Controls," prepared by Allen W. Rucker in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn. The experience of the last two years analyzed and charted in this booklet confirms the view that artificial increases in wage rates and restriction of working hours increase manufacturing costs, reduce sales, and, therefore, result directly in diminishing employment and reducing the annual income of workers. Sooner or later it must be recognized that artificial stimulants are detrimental to national recovery. What we need is more production, not less; more work, not less; more consumption and enjoyment of manufactured goods, not less.

* * *

Making Use of the Back of the Shipping Tag

An interesting use is being made of the back of their shipping tags by Steel & Tubes, Inc., Cleveland, Ohio. The company has developed a simplified bending system to facilitate the handling of metallic tubing for electrical purposes. Instructions for making accurate stubs, back-to-back bends, offsets, etc., are printed in diagram form on the reverse side of the company's shipping tags, which are attached to every shipment of conduit.

* * *

Westinghouse Electric & Mfg. Co. announces orders received for the first six months of this year equal to \$64,985,000, compared with \$53,893,000 for the same period last year. The net profits amounted to \$6,265,188, compared with a loss of \$31,725 for the same period last year.

NEWS OF THE INDUSTRY

California

W. S. LONG, formerly manager of mechanical sales in the Seattle district for the United States Rubber Products, Inc. (Mechanical Goods Division), 1790 Broadway, New York City, has been transferred to the Los Angeles district. C. W. GILMER, formerly sales manager in the San Francisco district, will succeed Mr. Long in the Seattle district.

Connecticut

R. T. PALMER, 883 Farmington Ave., West Hartford, Conn., is handling the sale of milling cutters manufactured by the Ingersoll Milling Machine Co., Rockford, Ill., including the new Zee-Lock cutter line, in New England and north-eastern New York. J. A. BOUSLOUGH, 606 North Ave., Wilkesburg, Pa., is covering the eastern Ohio and western Pennsylvania territory.

CARBOLLOY CO., INC., 2987 E. Jefferson Ave., Detroit, Mich., manufacturer of cemented-carbide tools and dies, has appointed the HARTLEY WIRE DIE CO., Waterbury, Conn., distributor of Carboly cemented-carbide dies.

LOUIS H. BRENDEN has joined the Consolidated Ashcroft Hancock Co., Bridgeport, Conn., in the capacity of assistant sales manager of the Hancock Valve Division.

Illinois and Indiana

M. B. SKIPPER has been placed in charge of sales in the Chicago territory for the Read Machinery Co., Inc., York, Pa., manufacturer of mixers for the chemical and industrial trade. Mr. Skipper will have an office with Goggin & Mills, 407 S. Dearborn St., Chicago, Ill.

O. Q. HINDS, formerly road machinery supervisor for the Allis-Chalmers Mfg. Co., Milwaukee, Wis., has joined the Caterpillar Tractor Co., Peoria, Ill., as special road machinery representative.

MARK SPRALEY, for several years assistant sales manager of the Joyce-Cridland Co., Dayton, Ohio, has assumed the duties of sales manager of the Pump Division of the Acme Machine Products Co., Muncie, Ind., manufacturer of the "Sure Flow" pump for handling coolants, water, oils, or fluids that are

filled with abrasives in connection with machine tools or general industrial applications.

Kentucky and Louisiana

HENRY A. PETTER SUPPLY CO., Paducah, Ky., has been appointed distributor of the crawler-mounted shovels, cranes, drag lines, and track type locomotive cranes built by the Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill.

UNITED STATES RUBBER PRODUCTS, INC., Mechanical Goods Division, 1790 Broadway, New York City, announces that its New Orleans branch is now located at 440 Canal St. This office was formerly at 202 Fulton St., New Orleans, La.

Massachusetts

NORTON CO., Worcester, Mass., announces a change in the set-up of its sales departments. The sales of all abrasive products have been combined into one division known as the "Abrasive Division," consisting of two sections—sales planning and development, and sales operation. The former section will be under the charge of WALLACE T. MONTAGUE, manager of sales planning and development. The sales operation section will be directed by W. R. MOORE, sales manager. The complete Abrasive Division will be under the supervision of W. L. C. NEILSON, vice-president in charge of sales, and H. K. CLARK, general sales manager.

The following changes in field organization personnel are also announced: C. W. JINETTE, for many years district manager for the state of Michigan, becomes regional manager of sales planning and development; P. H. CLAPP will be transferred from the Pacific Coast to Detroit and will become district manager for the state of Michigan; P. S. WISWELL, recently divisional manager for the Behr-Manning Corporation in Chicago, has been transferred to the Pacific Coast, where he will supervise the sales activities and personnel both of the Norton Co. and of the Behr-Manning Corporation.

NORTON CO., Worcester, Mass., announces that an Italian Norton Co. has been formed for the purpose of manufacturing grinding wheels and abrasive articles as required in that market. Associated with the Norton Co. in this venture will be the SOCIETA ANONIMA PRODUZIONE MOLE ABRASIVE RICHARD

GINORI, the most important of the present Italian grinding wheel manufacturers. The Norton interests will hold control and will manage the business. The official organization will be announced later. Manufacturing personnel has not been selected, but a few experienced men will be sent over as supervisors. Operations of the present plant of the S. A. Richard Ginori located at Corsico, a suburb of Milan, will be continued without interruption, but buildings and machinery will be modernized gradually until all varieties of Norton wheels can be produced.

GENERAL MACHINERY CORPORATION, 120 Federal St., Boston, Mass., has been appointed representative of the Erie Foundry Co., Erie, Pa., in Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island, handling the Erie line of forge shop equipment, hydraulic presses and rubber mill machinery.

Maryland

WILLIAM H. MEESE, vice-president of the Western Electric Co., New York City, and works manager of that company's Point Breeze plant in Baltimore, Md., recently received two honorary degrees in recognition of his professional attainments and his conspicuous civic leadership in Baltimore. The University of Michigan awarded Mr. Meese the honorary degree of Master of Engineering, and Temple University presented him with the degree of Doctor of Science.

P. J. POTTER, formerly second vice-president of the Pangborn Corporation, Hagerstown, Md., has been elected a director and vice-president. Mr. Potter will be directly responsible for engineering, sales, and production. He has been associated with the Pangborn organization for twenty years. Announcement is also made of the promotion of VICTOR F. STINE to the position of sales manager. Mr. Stine has been with the company for twenty-three years, and was recently elected second vice-president.

Michigan and Wisconsin

HYDRAULIC PRESS MFG. CO., Mt. Gilead, Ohio, manufacturer of H-P-M Hydro-Power Fastraverse presses, has just established a Detroit sales office in the Curtis Bldg., 2842 W. Grand Blvd. REIDER THORESON, who has been connected with the company for ten years in engineering and sales work, will be in charge of the new office.

FARREL-BIRMINGHAM CO., INC., 377 Vulcan St., Buffalo, N. Y., has appointed the STERLING-FRENCH MACHINERY CO., New Center Bldg., Detroit, Mich., sales representative for the Sykes gear generators in the Detroit territory.



Frank W. Curtis, for the Last Six Years Research Engineer for Kearney & Trecker

FRANK W. CURTIS, for six years research engineer with the Kearney & Trecker Corporation, Milwaukee, Wis., has resigned. While with the company, Mr. Curtis devoted himself to design and sales work of special machines and to the introduction of tungsten-carbide cutters and the development of the Milwaukee tungsten-carbide grinder. He has taken out many patents, and several are pending. Mr. Curtis has made no immediate plans for the future.

Ohio

S. D. WILLIAMS has been appointed manager of tube sales for the Timken Steel & Tube Co., Canton, Ohio. He was previously assistant director of sales. Mr. Williams has been connected with the steel industry since graduating from Lehigh University as a metallurgical engineer in 1913. For the last fifteen years, he has been in close personal contact with the alloy steel and tubing trade in all sections of the country, co-operating with manufacturers and users in the solution of their metallurgical and application problems.

HILL CLUTCH MACHINE & FOUNDRY Co., 6400 Breakwater Ave., Cleveland, Ohio, has purchased all the assets of the CANTON FOUNDRY & MACHINE Co., Canton, Ohio, manufacturer of "All-Steel" Alligator shears, portable cranes, and industrial and automobile turntables. The Canton Foundry & Machine Co. will continue to operate under its own name, but as a division of the Hill Clutch Machine & Foundry Co. The officers of the Canton division will be J. R. Bucher, president; A. C. McDaniel, vice-president, and Milo Firestone, secretary and treasurer.

NATIONAL MACHINERY Co., Tiffin, Ohio, announces that the company has received a decree in its favor from the United States District Court in Cleveland, covering the company's patent infringement suit against the Ajax Mfg. Co. for infringement of the patent on the extended rear bearing type heading slide, which is used on National high-duty forging machines. The Court has decided that the heading slide patent is valid and that it has been infringed.

W. M. McCONNELL has joined the engineering department of the Patterson Foundry & Machine Co., East Liverpool, Ohio, and will have charge of the drafting-room. Mr. McConnell was previously connected with the Koppers Co. and the American Cyanamid & Chemical Corporation.

INGERSOLL MILLING MACHINE Co., Rockford, Ill., announces the appointment of H. P. BOGGIS, 2075 E. 79th St., Cleveland, Ohio, as representative handling the sale of Ingersoll cutters in Cleveland and northern Ohio.

New York and New Jersey

DR. IRVING LANGMUIR, associate director of the General Electric Research Laboratory, was awarded the Holley medal for 1934 at the semi-annual meeting of the American Society of Mechanical Engineers in Cincinnati, Ohio. Dr. Langmuir received the medal for his "contributions to science and engineering, especially in the development of the gas-filled incandescent lamp, of the thoriated filament for thermionic emission, of atomic hydrogen welding, of phase-control operation of the thyatron tube, and for fundamental research in oil films. Dr. Langmuir has also been honored recently by being elected to foreign membership in the Royal Society of England. This is one of the highest honors that is bestowed by British scientists on fellow-workers in other countries, and is limited to fifty persons throughout the world. Dr. Langmuir is the only American industrial scientist so honored.

COLONEL V. A. ROOT has been appointed sales manager of the Seneca Falls Machine Co., Seneca Falls, N. Y. Mr. Root was previously sales manager of the W. F. & John Barnes Co., Rockford, Ill. JOSEPH H. FLATHER, formerly president of the Flather Co., Nashua, N. H., has been appointed chief engineer of the Seneca Falls Machine Co. GEORGE E. FOGARTY, European sales manager of the company, who has been spending several months in the United States, has returned to his European headquarters in Paris.

JOHN G. BARRY, senior vice-president of the General Electric Co., Schenectady,

N. Y., has retired, after more than forty-five years of service, and has been elected honorary vice-president. Mr. Barry will maintain an office in Schenectady and will be available for consultation.

SARCO Co., Inc., 40 E. 34th St., New York City, is equipping a new factory for the production of steam traps and temperature control apparatus. T. NAPIER ADLAM, chief engineer, is in charge of the selection of the new equipment.

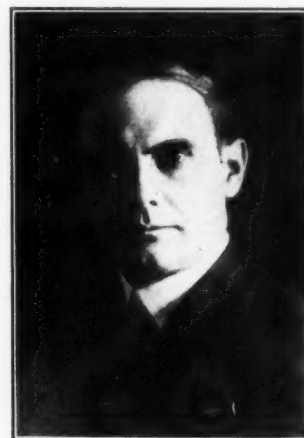
ELMER H. FLINN, formerly treasurer and general manager of the Alloy Metal Wire Co., Moore, Pa., has become associated with the Ludlum Steel Co., Watervliet, N. Y., in the capacity of supervisor of wire sales.

SIDNEY DIAMANT, president and general manager of the Diamant Tool & Mfg. Co., Inc., 401 Mulberry St., Newark, N. J., has been elected president of the Hudson River Valley Division of the Special Tool, Die, and Machine Shop Institute, Inc.

Pennsylvania

REED-PRENTICE CORPORATION, Worcester, Mass., has appointed the J. S. MILLER MACHINERY Co., 7 Wood St., Pittsburgh, Pa., exclusive agent in the Pittsburgh territory for the sale of the Reed-Prentice line of machine tools, including engine, tool-room, and production lathes, vertical milling machines, and die-sinking machines.

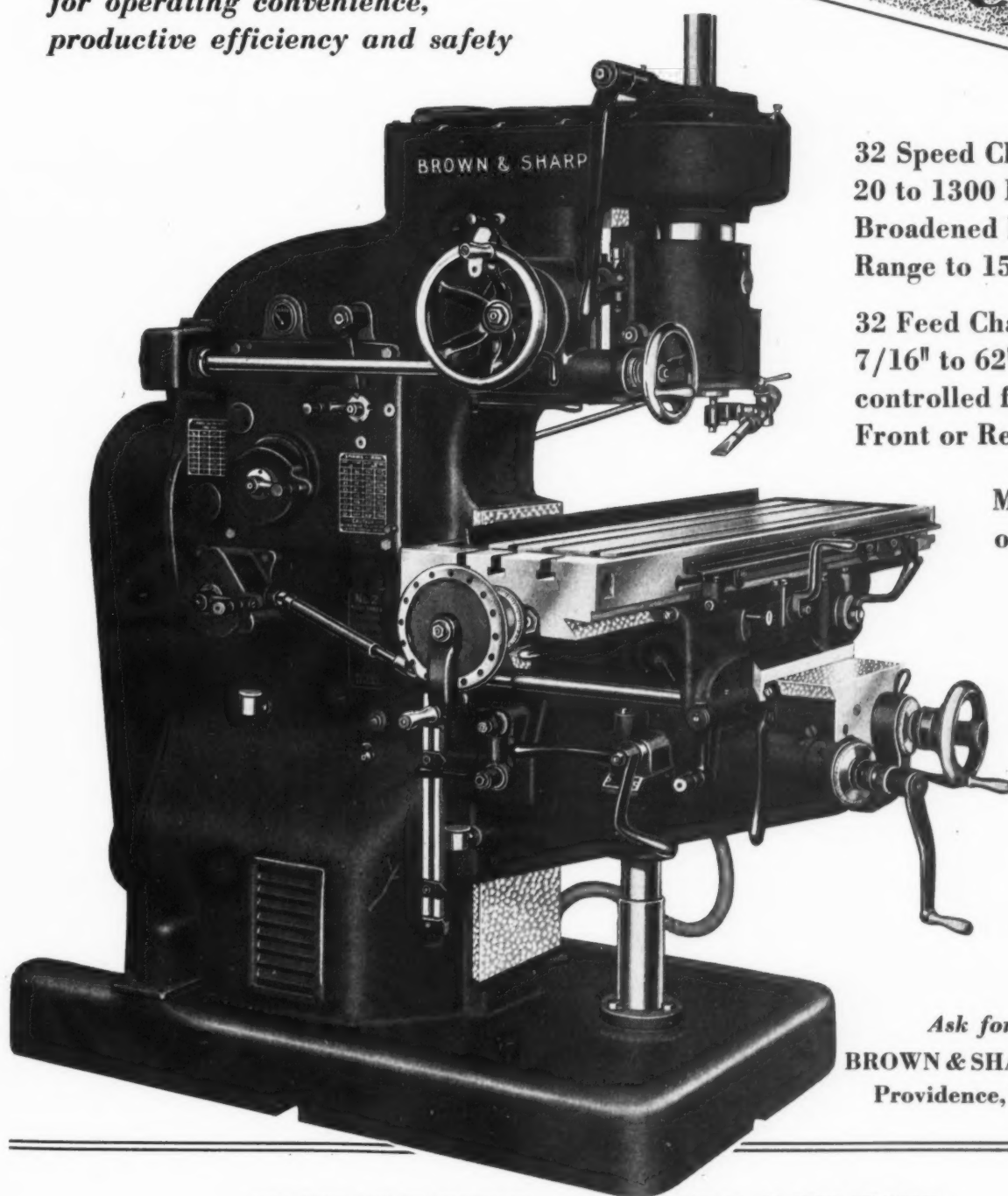
W. L. BATT, president of SKF Industries, Inc., Philadelphia, Pa., has been nominated president of the American Society of Mechanical Engineers for the year 1936. Mr. Batt has served the Society in many capacities, including that of vice-president.



W. L. Batt, President of SKF Industries, who has been Nominated President of the A.S.M.E.

A NEW High Speed Vertical

*Many advanced features
for operating convenience,
productive efficiency and safety*



32 Speed Changes,
20 to 1300 R.P.M. with
Broadened Back Gear
Range to 150 R.P.M.

32 Feed Changes,
7/16" to 62" per min.
controlled from
Front or Rear

Motor Drive
or Belt Drive

Ask for details
BROWN & SHARPE MFG. CO.
Providence, R. I., U. S. A.

BROWN & SHARPE No. 2 HIGH SPEED VERTICAL SPINDLE MILLING MACHINE

Exhibit Marks Fiftieth Anniversary of the Cincinnati Milling Machine Co.

The founding of the Cincinnati Milling Machine Co. in 1884 will be celebrated at the company's plant in Cincinnati during the week October 8 to 13, inclusive, by setting aside this period as an "open house" for the company's friends and customers and arranging an exhibit of the company's products.

The visitors will be shown a complete historical development of the company's machines, as well as an exhibit of the latest designs—the Hydro-Diematic, a new automatic profile and die-sinking machine for all kinds of die work; a complete line of broaching machines, including horizontal, duplex, and rotary types;

a new line of high-speed dial type machines for high-speed milling; a new centerless lapping machine for precision finishing of a variety of parts, such as piston-pins, steel bars, etc.; a new plain automatic milling machine designed especially for milling small parts for typewriters, business machines, etc.; one of the largest centerless grinders ever built; and a 16- by 144-inch plain self-contained grinding machine for precision grinding of rolls. The exhibition will also include standard milling machines and center type and centerless grinding machines. All machines will be fully demonstrated under power.

Who is to Run the Country's Business?

In an editorial in the *Link-Belt News*, published by the Link-Belt Co., Chicago, Ill., George P. Torrence, president of the company, makes the following concise comments on the present industrial situation:

"The answers pertaining to industry and business are not wholly in the hands of employes and management and owners. Others having no interest in industry and business, and little or no experience in either, are claiming the knowledge and ability to direct them and are attempting to dictate the answer to all our problems.

"Successful business and industrial enterprises are the source of livelihood for all citizens. Business and industry are the means for making and distributing the things everyone wants, and therefore for bringing material well-being to the individual.

"Our government never has operated business efficiently, and inefficient government operation means lower standards of living for everybody. If it becomes certain that the intention of our present government is to take over all business and industry, then employes, management, and owners, will have to fight to retain their personal liberty. If such a course should be the intent of our government, 'life, liberty, and the pursuit of happiness' would be in jeopardy.

"In defining the issue, it is well also to define the aims.

"President Roosevelt has stated his aims clearly. He is striving for

the health, happiness, and security of the people of the United States. In these aims all concur, and to achieve these aims, all enlisted under his banner. Now a year of arrested progress creates doubt of the methods selected by the President and his advisers. It is entirely appropriate that we analyze and criticize, and, if necessary, vigorously oppose any methods, if we believe them unlikely to achieve the President's aims. Particularly must interference with privately owned and controlled business and industry be opposed, if we continue to believe that they are the proper means for achieving the health, happiness, and security of the people of the United States."

* * *

The Manufacture of Autogiros

On page 721 of August *MACHINERY* it was mentioned that the firm of A. V. Roe & Co., Manchester, England, had acquired from the Cierva Autogiro Co., Ltd., the sole British rights for the manufacture and sale of the autogiro type of airplane. We are informed by the Cierva Autogiro Co., Ltd., of London, England, that the expression "sole British rights" was in error; it should have been said that the firm of A. V. Roe & Co., holds a non-exclusive license for the manufacture, use, and sale of Cierva autogiros. It is not the policy of the Cierva company to grant exclusive licenses, but rather to arrange for the manufacture of autogiros through a number of carefully chosen licensees.

Harnischfeger Fiftieth Anniversary Book

To celebrate half a century of business progress, the Harnischfeger Corporation, Milwaukee, Wis., has just published an unusually attractive anniversary book entitled "The Fiftieth Year." In words and illustrations, this book tells the story of an organization developed according to the true American tradition—a small beginning, early struggles against all kinds of adversities, pioneering of many types of equipment, and ultimate success.

In 1884, two young mechanical engineers in Milwaukee began manufacturing the first tri-motored electric cranes. Since then the company has built more than twelve thousand cranes, including every type known to modern industry, and has established itself as one of the leading builders of this type of equipment.

* * *

Ex-Cell-O Adopts the American Standard Bushing

Recently a new American standard bushing, proposed by a committee of the American Society of Mechanical Engineers, working in cooperation with the National Machine Tool Builders' Association, the Society of Automotive Engineers, and the drill jig bushing manufacturers, has been approved. The new bushings are designed to be furnished for drill sizes from 1/16 inch up to and including 1 3/4 inches.

The Ex-Cell-O Aircraft & Tool Corporation of Detroit, Mich., informs us that Ex-Cell-O bushings will be furnished to conform with the new American standard in the future, but, in accordance with a decision of the bushing manufacturers, the old standard bushings will be carried in stock for a reasonable length of time to enable manufacturers to obtain replacements. The new American standard bushings are now available from stock.

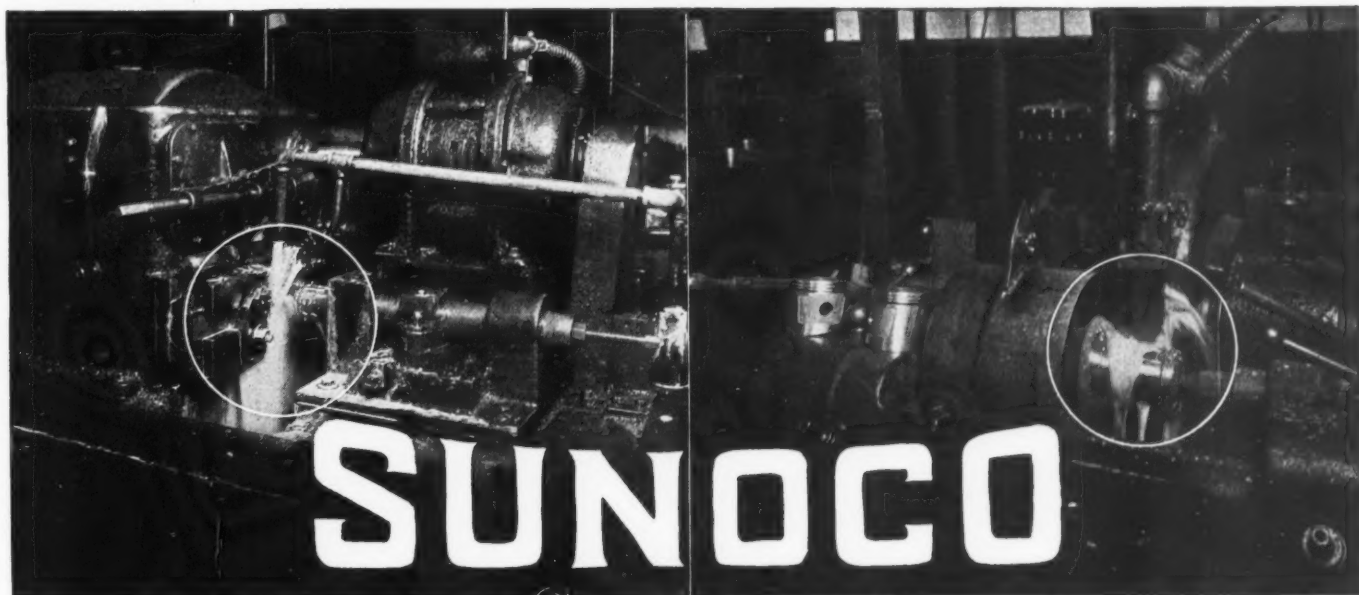
* * *

Industrial production in Soviet Russia during the first six months of 1934 was about 20 per cent in excess of the production during the corresponding six months of 1933, according to the *Economic Review of the Soviet Union*. The production increase was about 10 per cent in consumers' goods and over 25 per cent in "durable" goods.

Chosen

**... By Leaders in the
Metal Cutting Industry**

**... for Fast, Accurate
Production Runs!**



Emulsifying **CUTTING OIL**

• *Step Your Machines Up to Rated Capacity with Sunoco*

The high speed, flexibility and fast metal-removing capacity of modern machine tools are utilized to their fullest extent only when a cutting oil of known quality and proven worth is used.

With Sunoco Emulsifying Cutting Oil, increased machine speed, longer runs per tool grind, less lost time for resetting, greater accuracy and better finish are made possible.

• *Protects Against Skin Infections*

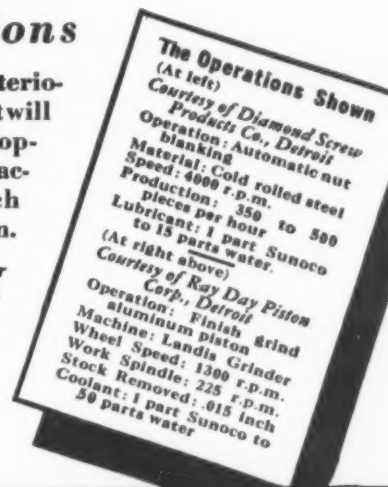
Sunoco is hygienic. Bacteriological tests prove that it will not permit the development of pus-forming bacteria, or pathogens which cause skin inflammation.

We suggest a test in your own plant under your own operating conditions. Our cutting oil engineers will gladly work with you.

SUN OIL COMPANY • PHILADELPHIA

*Offices and Warehouses
in more than 100 Cities*

Subsidiary Companies: Sun Oil Co., Ltd., Montreal • British Sun Oil Co., Ltd., London, England



NEWS OF THE INDUSTRY

California and Utah

MARLIN-ROCKWELL CORPORATION, Jamestown, N. Y., manufacturer of M-R-C ball bearings, has opened a factory branch at 550 Polk St., San Francisco, Calif. This branch will also serve as the San Francisco headquarters for the M-R-C Bearings Service Co., distributor of M-R-C ball bearings for automotive and industrial replacement purposes. James Ross Brown is manager of the new branch.

NATIONAL MOTOR BEARING CO. has acquired the factory building formerly occupied by the Pacific Coast Division of the Victor RCA Corporation in Oakland, Calif. A steady increase in demand for the oil and fluid seals and laminated shims made by the company necessitated this addition to its manufacturing facilities.

WROUGHT WASHER MFG. CO., Milwaukee, Wis., has established a branch office at Salt Lake City, Utah, under the personal supervision of W. H. Davidson of Hughson & Merton, western sales representatives of the company. The new office is at 324 Atlas Building, 36½ W. Second St. South, Salt Lake City.

Illinois

MIDWEST STAMPING & ENAMELING CO., Morrison, Ill., a newly formed corporation, announces the purchase of the factory formerly occupied by the Steel Box Division of the Illinois Refrigerator Co., of Morrison, Ill. The new firm has entered into the general contracting business for stampings and porcelain enamel sheet-steel parts. The president and treasurer of the company is S. S. BATTLES, chief engineer of the Ingersoll Steel & Disc Co., a subsidiary of the Borg-Warner Corporation, of Chicago, Ill. GEORGE GREENE, who has had many years of experience in the porcelain enamel field, has been appointed superintendent, and C. E. BULLOCK will be sales manager.

L. S. STEPHENS has been elected president of the Stephens-Adamson Mfg. Co., Aurora, Ill., manufacturer of conveyors, succeeding D. B. PIERSEN. Mr. Piersen, one of the founders of the firm in 1901, was made chairman of the board upon the resignation of W. W. Stephens of Pasadena, Calif. L. S. Stephens, the new president, has been active in the firm since 1914. In 1921 he was made superintendent and in 1926 vice-president in charge of production.

CHAIN BELT CO., Milwaukee, Wis., has appointed RAPP & HOLLINS, INC., 7001 N. Clark St., Chicago, Ill., exclusive

agent in northern Indiana, northern Illinois, eastern Iowa, and southern Wisconsin for Rex sand-handling equipment, mold conveyors, casting conveyors, and other foundry equipment.

Michigan, Wisconsin, and Minnesota

CARBOLLOY CO., INC., formerly located at 2481 E. Grand Blvd., Detroit, Mich., has moved its general offices, Detroit district office, and main manufacturing plant to larger quarters at 2985 E. Jefferson Ave., Detroit, where the company will occupy two entire floors of a modern manufacturing and commercial building. The new quarters, which contain approximately 85 per cent more floor space than the former quarters, have been equipped for an immediate increase in plant capacity on Carboloy standard and special tools and dies, and contain reserve space for future expansion.

ALLSTEEL PRESS CO., 12015 S. Peoria St., Chicago, Ill., manufacturer of the Verson Allsteel line of punch presses and sheet-metal working machinery, has appointed L. RAY PHIPPS, 918 Lapeer St., Flint, Mich., exclusive representative in the Flint, Lansing, Saginaw, and Bay City territory of Michigan.

R. X. RAYMOND, who has been associated with the Chain Belt Co., Milwaukee, Wis., for over fourteen years, has been appointed manager of the Minneapolis district. Mr. Raymond will succeed G. A. GUNTHER, who has been made district manager of the Detroit territory. The Minneapolis office is located at 808 La Salle Ave., and the Detroit office at 5169 Martin Ave.

DAYTON ROGERS MFG. CO., Minneapolis, Minn., manufacturer of metal stampings in small lots, has moved to larger quarters at 1845 E. Franklin, in anticipation of an increase in business.

New Jersey

HENRY M. CHASE has retired from the engineering staff of the Worthington Pump & Machinery Corporation, Harrison, N. J. Mr. Chase entered the engineering department of the Holyoke Works of the company (then the Deane Steam Pump Co.) in 1891, and with the exception of about a year spent with the De La Vergne Mfg. Co., has been continuously identified with the Worthington organization up to the time of his recent resignation. He plans to retire to his home town, Holyoke, Mass.

DR. R. W. MITCHELL, technical director of the Magnus Chemical Co., Garwood, N. J., recently sailed for an extended European business trip, with a view to visiting the company's branch in Paris and also the leading establishments in France, Germany, and Italy, ending his trip with a vacation stay in Spain.

New York

CARBORUNDUM CO., Niagara Falls, N. Y., announces that the company will conduct for the ninth season the well-known Carborundum band concert programs on the air, beginning Saturday, October 20, from 10 to 10:30 P.M. Eastern Standard Time. The broadcasts are made on the coast-to-coast network of the Columbia system. Francis D. Bowman, advertising manager of the Carborundum Co., will continue to write, produce, and announce these programs.

ERNEST A. EARLE has been appointed sales representative in Pennsylvania, New York, and New England for the industrial division of Aluminum Industries, Inc., Cincinnati, Ohio, manufacturer of Permite products. Mr. Earle will be located at 344 Stillwell Ave., Kenmore, Buffalo, N. Y. He was formerly connected with the Arrowhead Steel Products Co.

J. C. SPRAGUE has joined the Acheson Colloids Corporation, Port Huron, Mich., in the capacity of assistant secretary and assistant treasurer. His duties will be concerned with the patent, trademark, tax, and financial matters of the corporation. He will be located at the New York office of the company, 654 Madison Ave., New York City.

C. J. BIANCHI has been elected president of the S-B Gear Corporation, 640 W. 58th St., New York City, manufacturer of speed reducers of a new type. Mr. Bianchi has been in the gear business for more than twenty-five years, which time he has spent continuously with the Sier-Bath Co., of which he is now the head.

H. S. MCPHERSON has been appointed manager of mechanical sales in the St. Louis district for the Mechanical Goods Division of the United States Rubber Products, Inc., New York City. W. G. MUELLER has been appointed manager of mechanical sales of the Boston branch of the company.

HAUCK MFG. CO., 126 Tenth St., Brooklyn, N. Y., has purchased the assets and good will of the oil burner division of the Mead-Morrison Mfg. Co., Boston, Mass. The Hauck Mfg. Co. will continue to manufacture portable "Handi" forges for rivet heating and portable torches for general heating.

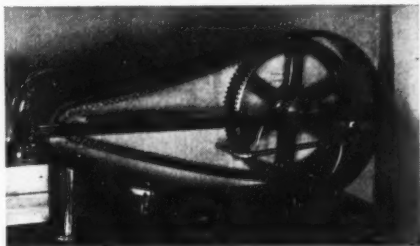
SIER-BATH CO., 640 W. 58th St., New York City, manufacturer of precision gears for the last twenty-five years, has contracted with the S-B GEAR CORPORA-

POWER TRANSMISSION NEWS

A recent order for drives for a stern-wheel river boat led to an investigation into the performance of two 115 h.p. drives installed on the river towboat *Tennessee*, in 1929. Power plant and transmission are a Diesel engine coupled to a D.C. generator, driving two 115 h.p. motors.

Both motors drive the stern wheel through two Morse Silent Chain Drives, each 12 inches wide, on 19 and 107 tooth sprockets and eight feet long between centers. Normal full load motor speed is 575 r.p.m.

The boat is now operated by the War Department, and government engineers report on this 5-year-old installation: "No troubles have been experienced. The towboat has traveled approximately 14,000 miles. ... "and ... if we were to design additional towboats of this type, I have no doubt that drives similar to those used on the *Tennessee* would be employed."

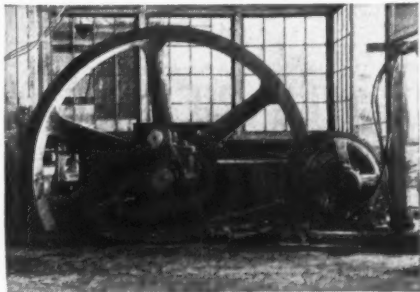


The above picture shows an exhibition drive equipped with Morse Ring Oiler, the case has a glass front.

The Morse Ring Oiler provides a continuous flow of oil upon the chain while operating. Morse chains oiled by this simple device will operate at highest efficiency and require little attention. The oil is carried from a reservoir in the bottom of the case, trapped in a cup, led through the pipe and allowed to drip on the chain, the motion of the chain splashes the oil stream sufficiently to uniformly lubricate the entire width of the chain.

Morse Speeds Up Power Change-Over

Recently a rubber mill in changing over from steam to electric power was faced with the problem of placing the transformers in the engine room, and the switchboard in the space occupied by the cylinder of the Corliss engine which was coupled to the main line shaft. Since the main line shaft had to be driven until the



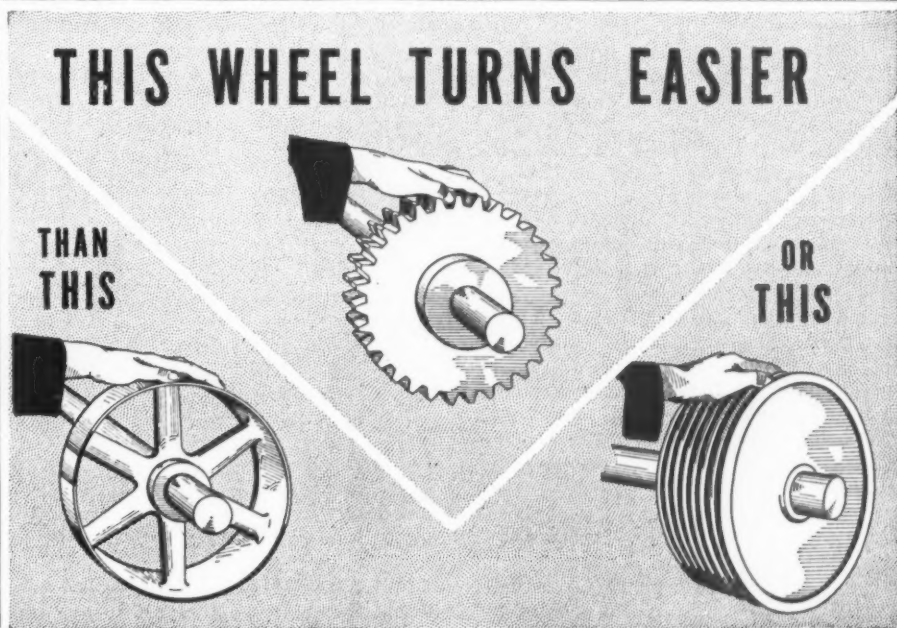
power could be turned on, the situation was quite complicated.

One hundred fifty h.p. was needed by the mills on this shaft. A Morse engineer found that the only space available for a

chain drive sprocket on the engine shaft was that occupied by the eccentrics. This temporary installation was going to be used for only about six months, and with the large overload capacity in a chain drive, a chain which normally would have been rated at about 100 h.p. could be safely used for this short period. This chain, 10" wide, just cleared the flywheel and the bearing stand. A motor was rented and mounted on a suitable foundation. At noon, one Saturday, the connecting rod and eccentrics were removed, a keyway cut in the shaft, and the split chain sprocket was put in place. The Morse Silent Chain was put on and the

plant was ready for operation before Monday morning.

During the time necessary to complete the electric installation, the temporary motor carried the shop along, the only attention required being an occasional application of grease on the chain. The new electric drive included two 75 h.p. motors for mills and a 50 h.p. and 75 h.p. for two calendars, all with Morse Chain Drives. A 200 h.p. direct-connected, slow-speed, synchronous motor is used on another mill line shaft. When it becomes necessary to replace one of the other chains, the temporary chain can be re-assembled into the proper width and used.



TEETH—NOT TENSION TURN CHAIN DRIVE SHAFTS

Study the above illustration. You'll immediately see why chain drives are positive. They just can't slip. Bearing load is reduced. Chain drives deliver power with an average of 98.6% efficiency.

This high efficiency coupled with long life, low first cost, ease of installation and reduced maintenance costs means savings in production.

Ask for more information

MORSE CHAIN COMPANY

A Division of Borg-Warner Corporation
ITHACA, NEW YORK

tion to manufacture that company's complete line of speed reducers.

CHICAGO PNEUMATIC TOOL CO., 6 E. 44th St., New York City, announces a change of address in its Birmingham, Ala., office, from 1829-31 S. Second Ave. to 211 S. 20th St. W. S. Lynch is manager of the Birmingham district office.

H. J. FRENCH, in charge of alloy steel development with the International Nickel Co., Inc., 67 Wall St., New York City, addressed the American Society for Metals at a recent meeting in St. Paul, Minn., on the subject "The Role of Nickel in Steels."

ACHESON COLLOIDS CORPORATION, Port Huron, Mich., announces the removal of its New York office from 654 Madison Ave. to 444 Madison Ave., New York City.

Ohio

STEEL & TUBES, INC., 224 E. 131st St., Cleveland, Ohio, has recently established distributors of electrically welded mechanical tubing in the important tubing centers of the United States. The first warehouse stock of mechanical tubing established by Steel & Tubes, Inc., was with the Tubular Service Corporation of New York, Philadelphia, and Boston. Since then stocks have been put in by the Service Steel Co., Detroit, Mich.; Williams & Co., Pittsburgh, Pa.; Hamilton Steel Co., Cleveland, Ohio; and Edgar T. Ward's Sons Co., Chicago, Ill.

O. J. HUNTLEY, precision boring demonstrator for the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., for several years, has been transferred to the sales staff and will be located in the Dayton territory. Mr. Huntley will handle the complete line of Ex-Cell-O products, consisting of all types of cutting tools, bushings, spindles, multiple equipment, and precision boring equipment.

R. J. ROY, formerly Cleveland branch manager for the pump and electrical department of Fairbanks, Morse & Co., was recently appointed assistant manager of the Allen-Bradley Co. at Cleveland, Ohio. Mr. Roy is a graduate of the Massachusetts Institute of Technology, and has long been identified with the sales of electrical equipment in the Cleveland, Pittsburgh, and Cincinnati territories.

MERRITT C. WEMPLE, formerly a sales engineer with the Geo. D. Roper Corporation, Rockford, Ill., has opened a branch office at 320 Rockefeller Bldg., Cleveland, Ohio. The service offered by Mr. Wemple will be supplementary to the present Roper representation in the Cleveland territory.

MANUFACTURER'S SUPPLY CO., which has recently moved to a new warehouse and general office at 3528 E. 76th St.,

Cleveland, Ohio, has been appointed distributor for the line of tools, files, saws, knives, and steel manufactured by Henry Disston & Sons, Inc., Philadelphia, Pa.

VINCENT K. SMITH has been appointed motor sales manager of the Ohio Electric Mfg. Co., Cleveland, Ohio.

Pennsylvania and Maryland

UNION SWITCH & SIGNAL CO., of Pittsburgh, Pa., is discontinuing its commercial drop-forge business and transferring all dies and unfilled orders to the CHAMPION MACHINE & FORGING CO., of Cleveland, Ohio. Finley L. Walton, who has directed commercial drop-forge sales for the Union Switch & Signal Co., becomes affiliated with the Champion Machine & Forging Co. in a similar capacity.

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill., has appointed the ALLEGHENY EQUIPMENT CORPORATION, 1218 Grant Bldg., Pittsburgh, Pa., distributor for Link-Belt crawler shovels, cranes, draglines, and locomotive cranes.

POOLE FOUNDRY & MACHINE CO., 3701 Clipper Mill Road, Woodberry, Baltimore, Md., announces the acquisition of all domestic and foreign patents pertaining to the Poole all-metal gear lubricated type flexible coupling formerly owned by the Poole Engineering & Machine Co.

COMING EVENTS

OCTOBER 1-2—Meeting of the trustees of the SPECIAL TOOL, DIE, and MACHINE SHOP INSTITUTE at the Hotel Pennsylvania, New York City. Roy T. Wise, executive secretary, 1225 Guarantee Title Bldg., Cleveland, Ohio.

OCTOBER 1-5—NATIONAL METAL CONGRESS AND EXPOSITION, Commerce Hall, Port Authority Bldg., New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, director.

OCTOBER 1-5—Annual convention of the AMERICAN SOCIETY FOR METALS (formerly the American Society for Steel Treating), New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, secretary.

OCTOBER 1-5—Fall meeting of the AMERICAN WELDING SOCIETY at the Hotel New Yorker, New York City. M. M. Kelly, secretary, 33 W. 39th St., New York City.

OCTOBER 1-5—Annual meeting of the WIRE ASSOCIATION at the Hotel New

Yorker, New York City. R. E. Brown, secretary, 17 E. 42nd St., New York City.

OCTOBER 1-5—Fall meeting of the IRON AND STEEL DIVISION of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Pennsylvania, New York City. P. T. Wetter, assistant secretary, 29 W. 39th St., New York City.

OCTOBER 1-5—Twenty-third annual SAFETY CONGRESS AND EXPOSITION, to be held at Cleveland, Ohio, under the auspices of the NATIONAL SAFETY COUNCIL, Inc., 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 3—Meeting of the Code Authority of the Special Tool, Die, and Machine Shop Industry at the Hotel Pennsylvania, New York City.

OCTOBER 10-11—Production meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS to be held at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, general manager, 29 W. 39th St., New York City.

OCTOBER 15-19—Second annual Industrial Materials Exhibit at the Park Central Hotel, New York City.

OCTOBER 22-23—Semi-annual meeting of the American Gear Manufacturers' Association at the New Hotel Pfister, Milwaukee, Wis. J. C. McQuiston, manager-secretary, Penn-Lincoln Hotel, Wilkesburg, Pa.

OCTOBER 22-26—Annual meeting of the AMERICAN FOUNDRYMEN'S ASSOCIATION and Fifth International Foundry Congress and Exposition in the New Auditorium, Philadelphia, Pa. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

NOVEMBER 8-24—Exposition of machinery and tools at Olympia, London, England.

NOVEMBER 14-16—Annual meeting of the International Acetylene Association at the William Penn Hotel, Pittsburgh, Pa. H. F. Reinhard, secretary, 30 E. 42nd St., New York City.

DECEMBER 3-7—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Engineering Societies Building, 29 W. 39th St., New York City.


OBITUARIES

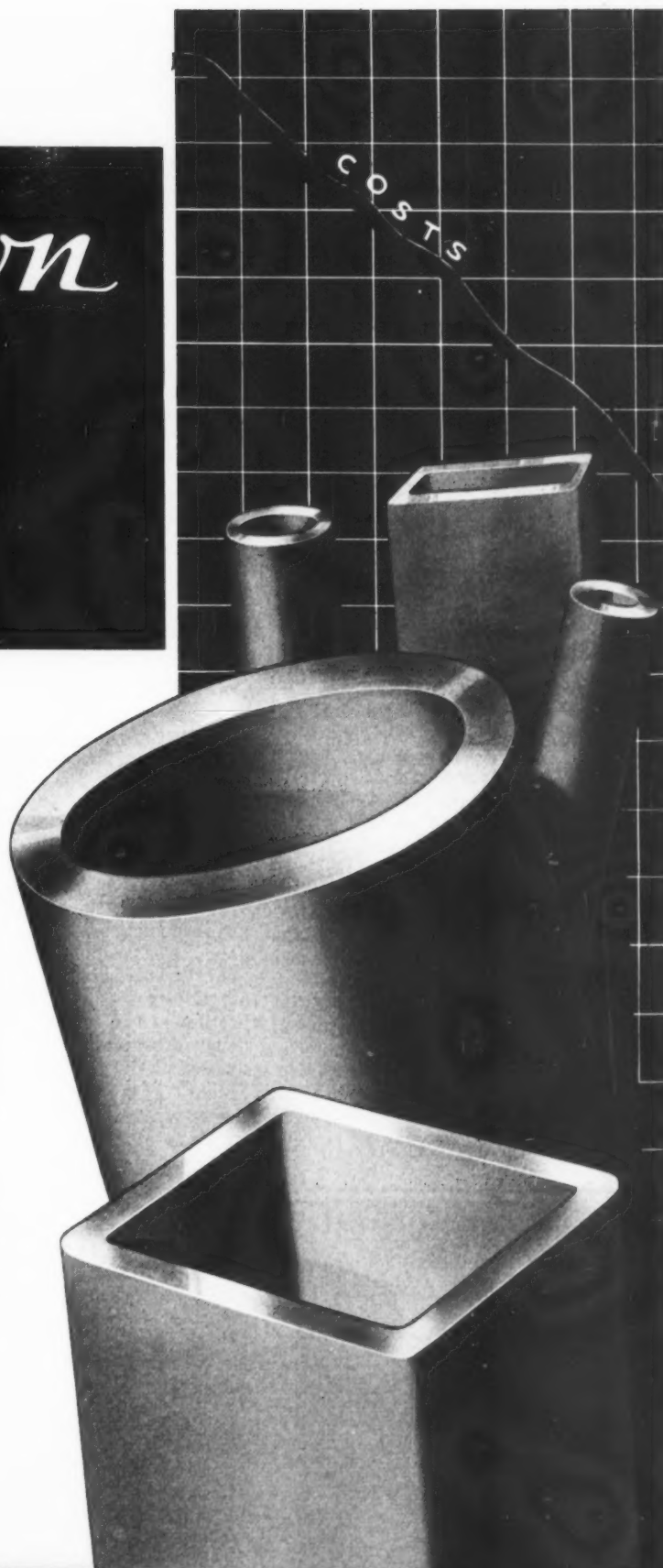
A. D. CHANDLER, sales engineer for Aluminum Industries, Inc., Cincinnati, Ohio, died at the home of his father in Kennett Square, Pa., on September 4, following a long illness. Mr. Chandler was with the Aluminum Industries, Inc., for about four and a half years, making his headquarters in Chicago.

Pull down

When you adopt NATIONAL-SHELBY Seamless Tubing for making any part, the "COST" line on your graph sheet goes down. This is being turned to account by an increasing number of manufacturers who use one or another of the various shapes, sizes, and wall-thicknesses of NATIONAL-SHELBY Tubing as a short-cut in fabrication. They find that machining operations are minimized, labor economized, and wear on tools very much reduced. As for the practical result—they know the finished part will be of fine, uniform steel structure throughout.

When you specify seamless tubing, be sure and say NATIONAL-SHELBY. Then you obtain the quality and dependability that have made the name SHELBY preeminent. The experience and resources of the world's largest manufacturer of tubular products are behind every length of this product. Send for handbook "NATIONAL-SHELBY Seamless Tube Standards"

NATIONAL TUBE COMPANY • Pittsburgh, Pa.
Subsidiary of United  States Steel Corporation



SEAMLESS MECHANICAL TUBING

22 and 23, his observations on business conditions abroad. While in Denmark, Mr. Christensen was received by His Majesty King Christian X, to whom, as president of the Danish Society of America, he conveyed greetings from the Danish-born people here to the King.

GEORGE D. MILLER Co., 2168 W. 100th St., Cleveland, Ohio, has been appointed exclusive representative in the Cleveland territory for the Lees-Bradner Co., 6210 Carnegie Ave., Cleveland, Ohio, manufacturer of gear-hobbing machines, gear generators, thread milling machines, and gear-testing machines.

OBITUARIES

Dr. Calvin W. Rice

Dr. Calvin Winsor Rice, secretary of the American Society of Mechanical Engineers since 1906, died October 2 in New York from a cerebral hemorrhage at the age of sixty-five years.

Dr. Rice was born at Winchester, Mass., and graduated from the Massachusetts Institute of Technology in 1890. He received a Doctor's Degree in Engineering from the Technical Institute at Darmstadt, Germany, in 1926. After graduating, he was employed with the Thomson-Houston Electric Co. and subsequently became electrical engineer with the General Electric Co. when that company absorbed the Thomson-Houston Co. Later he was electrical superintendent with the Anaconda Copper Mining Co. and the Silver Lake Mines Co. Returning to the East, he was employed by several electrical companies in New



Calvin W. Rice

York, and in 1903, became vice-president and sales manager of the Nernst Lamp Co. In 1915, he served as a member of the jury of awards of the San Francisco Exposition.

At the time of his death, Dr. Rice was secretary and a member of the board of trustees of the New York Museum of Science and Industry, a member of the corporation of the Massachusetts Institute of Technology, and national counselor of the Purdue Research Foundation. He was also a member of a great number of American and foreign engineering societies. He was honored by having conferred upon him the Knight Cross of the Order of the White Lion of Czechoslovakia, and the Medal of Honor of the Society of German Engineers for "promoting mutual international interests of engineers of the entire world."

As secretary of the American Society of Mechanical Engineers for almost thirty years, Dr. Rice had an unusually wide acquaintance among engineers and counted among his friends some of the most prominent leaders in American industry. His passing will be deeply regretted throughout the engineering field.

Dr. Rice is survived by his widow; a son, Edward Winslow; and a daughter, Marjorie.

John Anton Hartness

John Anton Hartness, for about thirty years manager of the British office of Jones & Lamson Machine Co., Springfield, Vt., died in London, September 25, at the age of eighty-one. He was a brother of the late James Hartness, formerly president of the Jones & Lamson company.

John Anton Hartness retired about three years ago from his connection with the Jones & Lamson organization, but continued to reside in England. For over ten years, he was a member of the London Chamber of Commerce and was also a member of the American Chamber of Commerce in London and of the American Society there. He was also a fellow of the Royal Society of Arts.

R. Y. Ferner

R. Y. Ferner, for many years head of the R. Y. Ferner Co., Washington, D. C., importer of high precision measuring equipment, died on October 7 in New York City, where he was displaying precision equipment as American representative of the Société Genevoise d'Instruments de Physique. He also represented the Société Anonyme de Com-metry Fourchambault et Decazeville.

Mr. Ferner was born in Chicago fifty-eight years ago. After graduating from the University of Minnesota, he became a physicist at the Bureau of Standards in the Division of Weights and Measures, and subsequently was made chief



R. Y. Ferner

of his section. At one time, because of his great interest and proficiency in mathematics, he obtained a contract with the Naval Observatory as a computer. He was a member of the American Physical Society and of the American Optical Society.

HARRY E. HENRY, in charge of the northeastern section of Ohio for the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., died suddenly on September 20 at his home in Cleveland, Ohio. Mr. Henry had represented the Ex-Cell-O organization for many years in the Cleveland territory, and recently had also represented the Continental and Krueger-Wayne divisions of the company.

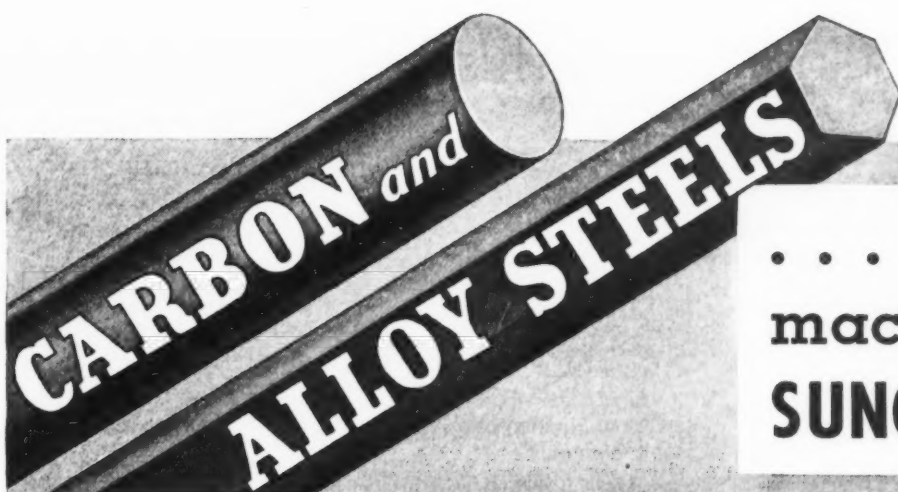
COMING EVENTS

NOVEMBER 8-24—Exposition of machinery and tools at Olympia, London, England.

NOVEMBER 14-16—Annual meeting of the INTERNATIONAL ACETYLENE ASSOCIATION at the William Penn Hotel, Pittsburgh, Pa. H. F. Reinhard, secretary, 30 E. 42nd St., New York City.

DECEMBER 3-7—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Engineering Societies Building, 29 W. 39th St., New York City.

DECEMBER 3-8—ELEVENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York City. Manager Charles F. Roth, International Exposition Co., Grand Central Palace.



... are easily machined when **SUNOCO** is used

STEELS of high-grade physical characteristics and free machining properties are widely available. But to machine them economically, with accuracy and desired finish, these three important factors must be present:

- Modern machine tools.
- Correct tooling.
- An efficient cutting lubricant.

Clean and Accurate Cuts Made With Sunoco

Small tools which dull rapidly are doubly disadvantageous: They tear the metal... inaccurate tolerances and faulty finishes result. Such work fails to pass inspection.

With Sunoco Emulsifying Cutting Oil, tools

make cuts that are clean and accurate. Resharp-ening and resetting are reduced to a minimum—and the percentage of work to pass inspection is increased.

Operators Appreciate Sunoco's Advantages

The superior lubricating and refrigerating qualities of Sunoco are acclaimed by machine operators. Experience has shown them that when Sunoco is utilized, they are assured of *continued, dependable, trouble-free machine tool performance.*

The Sun Oil Company offers the services of its Cutting Oil Engineers to help the industry in the application of Sunoco to specific metal cutting operations.

Operation: Cutting splines on final drive shaft.
Machine: Lees Bradner 5 AC Hobber
Material: SAE 3145
Feed: .050 inch
Speed: 80 feet per minute
Lubricant: 1 part Sunoco to 10 parts water

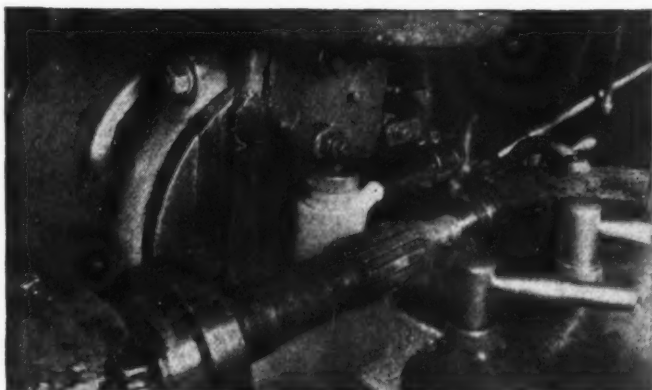
Courtesy of
Cleveland Tractor Co.
Cleveland

SUNOCO

EMULSIFYING
CUTTING OIL

Operation: Finish grinding lower bearing and shoulders on track wheel shaft
Machine: Norton Grinder
Material: SAE 1035
Stock Removed: .025 inch (.010 inch on shoulder)
Wheel: 24 in. diam., 5½ in. wide
Wheel Speed: 1050 r. p. m.
Surface Speed: 68 ft. per min.
Coolant: 1 part Sunoco to 40 parts water.

Courtesy of
Cleveland Tractor Co.
Cleveland



SUN OIL COMPANY PHILADELPHIA, PA., U. S. A. *Subsidiary • Sun Oil Co., Ltd., Montreal & Toronto*
Offices and Warehouses in more than 100 Cities Companies • British Sun Oil Co., Ltd., London, England

Classified Contents of this Number

DESIGN, FIXTURE AND TOOL

- Double-Acting Clamp for Milling Fixture 165
- Adjustable Quick-Locking Vise—*By A. Wasbauer* 165
- Shear Blades for Cutting off Channel Sections .. 167
- Quick-Acting Chuck Used in Grinding Concentric Bores in Sleeve—*By F. P. Smith* 167

DESIGN, MACHINE

- Finding Diameter of Cylinder from Measurement of Arc—*By William S. Rowell*..... 142
- Art in Engineering Design—*By G. L. Schwarz* ... 143
- The Inventor's Key to Success is to Think of it First 154
- Cam and Roller Mechanism for Obtaining Instantaneous Movement—*By A. R. Kligman*..... 155
- Mechanism for Obtaining Intermittent Slide Movement from Oscillating Lever—*By J. E. Fenno* .. 156
- Variable-Stroke Ratchet Movement—*By L. Kasper* 157
- Improvements in Motor Mounting Methods—*By J. V. Hunt* 163
- MACHINERY'S NEW HANDBOOK..... 195

DIEMAKING, DIE DESIGN, AND PRESS WORK

- Assembling Three Sizes of Piercing Dies on One Bolster—*By H. R. Schmidt* 166
- Die for Producing Lock-Washers—*By Emil Gerhart* 166

EDUCATION, TRADE AND ENGINEERING

- The Norton Co.'s New Plan for Apprentice Training 170

MANAGEMENT PROBLEMS

- Accurate Costs Increase Profits 143
- What is Ahead in the Machinery Industries?..... 145
- Good Lighting in Machine Shops 149
- Do Present Government Policies Help or Hamper Recovery? 154
- There is a Place for Machine Equipment in the Office Too 154
- How Government Policies Affect the Machinery Industry 161
- Higher Wage Rates Versus Higher Annual Income 168
- Industry's Part in Social Progress 173

MATERIALS, METALS, AND ALLOYS

- Boron Carbide—Next to the Diamond the Hardest Material Known 177

- "Fernico"—a Metal Alloy that Fuses with Glass .. 177
- Bakelite as a Fireproof Material for Ship Construction 178
- Plykrome Pipe Withstands Friction from Compressed Air 178

MEETINGS AND CONVENTIONS

- The Foundrymen's Association Meeting in Philadelphia 142
- Ralph E. Flanders, New President of the American Society of Mechanical Engineers 144
- Automotive Engineers Discuss Cutting Oils, Broaching, and Balancing 148
- Annual Meeting of Packaging Machinery Manufacturers 151
- Gear Manufacturers Meet in Milwaukee 171
- Machine Tool Builders Adopt Resolution on Re-Employment 172

NEWS OF THE INDUSTRY

- Engineering News Flashes 152
- New Publication of Motor and Generator Standards 157
- New Plants in Soviet Russia 160
- Timken Awarded First Prize in Advertising Contest 162
- Cincinnati Milling Machine Co.'s Fiftieth Anniversary Exhibition 169
- News of the Industry 198

SHOP PRACTICE

- An Equipment Manufacturer Who Practices What He Preaches—*By Charles O. Herb*..... 137
- Household Device Serves as Thumb-Tack Lifter—*By Frank W. Bentley, Jr.* 142
- Milling the Teeth of Throttle-Lever Quadrants Nine at a Time—*By Oliver Herbert* 147
- New Helical Lead Checking Machine 150
- Applying Finish to Chevrolet Bumpers—*By J. M. Bonbright* 158
- Stud-Removing Kink—*By William C. Betz* 162
- Why Springs Have Their "Set" Removed—*By Ferdinand Hintz* 164
- Honing Applied to External Surfaces 171
- Shop Equipment News 179

WELDING AND CUTTING PRACTICE

- Portable Oxy-Acetylene Machine Simplifies Metal Shaping Jobs 147

Your Progress Depends Upon Your Knowledge of Your Industry

The Eleventh National Exposition of Power and Mechanical Engineering

An exhibition of unusual scope will be held in the Grand Central Palace, New York City, during the week beginning December 3. At that time, the eleventh National Exposition of Power and Mechanical Engineering will place on exhibit recent advances in the fields of power equipment and power transmission. Exhibits of interest in many kindred fields will also be included. For example, there will be air-conditioning and refrigeration equipment and a complete display of industrial fans and blowers; and there will be demonstrations of modern methods of factory, floor, and overhead cleaning, and of many devices for the vacuum-cleaning of industrial equipment.

While the largest part of the exhibit will naturally be given over to power plant equipment and accessories, there will be a large number of exhibits devoted to mechanical power transmission. The materials-handling section will include lift trucks and other mechanical material-handling means.

Obviously, in the mechanical power transmission exhibits, bearings occupy an important part. Practically all of the leading ball and roller bearing manufacturers will be represented. The Norma-Hoffmann Bearings Corporation of Stamford, Conn., will exhibit a line of precision ball, roller, and thrust bearings, as well as self-aligning pillow blocks. This exhibit will include the "4000" series of ball bearings shown at A, Fig. 1, the distinguishing feature of which is a snap ring of steel inserted in a groove in the periphery of the outer race close to one face. This ring, protruding around the outer race, eliminates one shoulder from the housing, thus reducing the cost of machining and providing a more compact mounting. At B is shown a type which closely resembles that shown at A, except that a side plate or shield is added for retaining grease. Then there is also the felt-protected bearing shown at C, with a removable seal between metal plates; the type with single felt seal and one side plate or shield wholly enclosed for the retention of lubricant, as shown at D; and the sealed bearing with two removable felt seals shown at E.

The SKF Industries, Inc., Philadelphia, Pa., will display a complete line of heavy-duty ball and roller bearing pillow blocks, ball and roller bearings, and ball-bearing hangers.

A new oil seal that is designated the Garlock

Klozure is to be exhibited by the Garlock Packing Co., Palmyra, N. Y. This seal, as shown in Fig. 2, has been developed to meet the requirements of a dependable oil seal. The advantages of the new packing ring that are especially pointed out by its makers are uniformity in performance, resistance to high temperatures, resistance to oils, and a low coefficient of friction.

Another exhibit in the mechanical power transmission field will be that of the Morse Chain Co., Ithaca, N. Y. This company has moved practically its entire exhibit directly from the Century of Progress Exposition at Chicago to the New York Power Show. The exhibit will include silent and roller chains and sprockets, flexible couplings, and the new Morse Kelpo free-wheeling clutch. It is expected that the company will also show, for the first time, a Morflex coupling larger than those formerly made and having a capacity up to 400 horsepower.

Many new instruments for the power field will be shown. The Bristol Co., Waterbury, Conn., will exhibit, among other equipment, its new Metameter for "telemetering" pressure, liquid levels, temperatures, and flow and motion. This device consists essentially of two instruments—a transmitter and a receiver. The transmitter is located close to the equipment in which the pressure, liquid

level, temperature, flow, or motion to be measured occurs. Its function is to measure the units and transmit their value to the receiver, which is located at a distance from the transmitter that may be measured either in feet or miles.

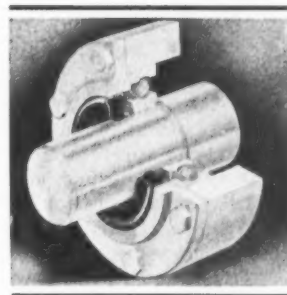


Fig. 2. A New Oil Seal Exhibited by the Garlock Packing Co.

At the receiver end, the operator, superintendent, or manager can observe the reading. The transmitter and receiver are connected electrically by two wires.

A number of new instruments will be shown by the Taylor Instrument Companies, Rochester, N. Y. Among these are: "Fulscope" recording temperature controllers for power plant use; recording thermometers and pressure gages, and "Dubl-Response" control units, also intended for power plant applications; flow meters for steam, air and gas; and press-roll load recorders. The latter instruments, while developed specifically for recording the press-roll pressures on paper machines, are applicable wherever an accurate check on applied pressures or tension has a direct relation to economical production and to the quality of the product.

Among other exhibits of which we have received advance notice should be mentioned the new Olympic bronze metal in the booth of the Chase Brass & Copper Co., Waterbury, Conn.; the demonstration of belting through the use of a special dynamometer in the booth of the Graton & Knight Co., Worcester, Mass.; steel castings made by a new foundry process exhibited by the Lebanon Steel Foundry, Lebanon, Pa.; a line of industrial filters shown by Motor Improvements, Inc., Newark, N. J.; the Star "Moly" hacksaw blades exhibited in the booth of Clemson Bros., Inc., Middletown, N. Y.; and a demonstration of the pulling power of Vim-Tred belting and of the characteristics of Sta-Put lubricants by E. F. Houghton & Co., Philadelphia, Pa.

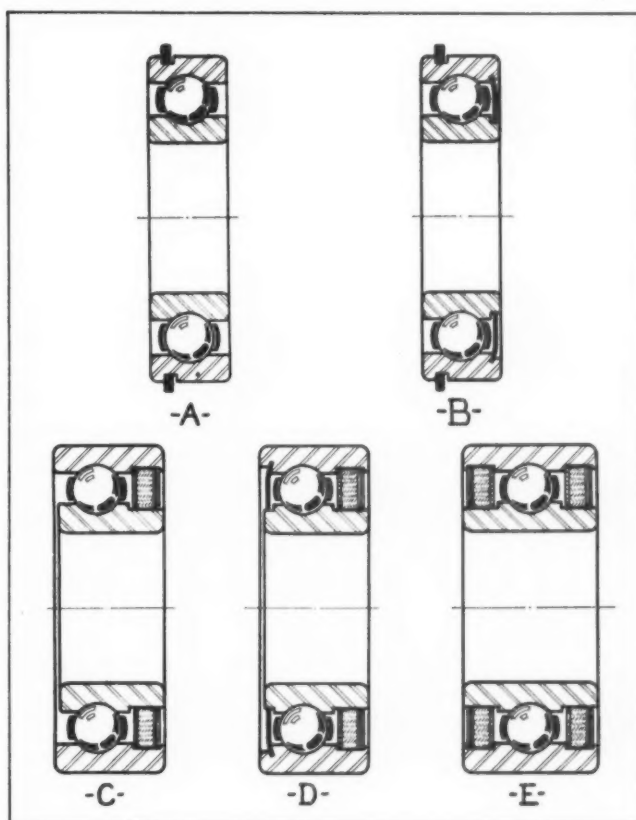


Fig. 1. Improved Types of Ball Bearings Exhibited by the Norma-Hoffmann Bearings Corporation

NEWS OF THE INDUSTRY

Connecticut

FRED B. SMITH recently completed fifty years of association with the Hendey Machine Co., Torrington, Conn. He received congratulations from a host of friends, and was presented with a bouquet of fifty chrysanthemums by the company in commemoration of the event. Mr. Smith started working for the company in October, 1884, as an apprentice. At the end of his apprenticeship he became a journeyman machinist and later a foreman of the shaper department. In 1900, Mr. Smith was put in charge of the company's exhibit at the Paris Exposition, and in 1904 he had charge of the installation and operation of the exhibit at the St. Louis Exposition. On two different occasions he was sent abroad to help the foreign agencies develop their business in Hendey machines. However, it has been as a traveling salesman, working chiefly in his home state, that Mr. Smith has firmly established himself and made a wide circle of friends.

Georgia and Texas

LINK-BELT Co., 910 S. Michigan Ave., Chicago, Ill., has purchased the physical assets of the BAILEY-BURRUSS MFG. Co., 1116 Murphy Ave., Atlanta, Ga. All the divisions of the Link-Belt's Atlanta sales office, heretofore located in the Haas-Howell Bldg., are being moved to the Bailey-Burruss plant, which will hereafter be known as the Atlanta plant of the Link-Belt Co. I. H. BARBEE, formerly manager of the Atlanta office, and more recently connected with the Phila-

delphia plant, will have charge of the new division. R. L. LOWDER and J. R. MARTIN of the Link-Belt Atlanta office, as well as J. O. BAILEY of the Bailey-Burruss Mfg. Co., will continue as part of the Atlanta organization.

REVERE COPPER & BRASS, INC., 230 Park Ave., New York City, announces the opening of an office at 804 Tower Petroleum Bldg., 1905 Elm St., Dallas, Tex.

Illinois and Wisconsin

RALPH R. WEDDELL, consulting engineer who recently returned from England after establishing the manufacture of serrated-blade cutters there, is now connected with the Ingersoll Milling Machine Co., Rockford, Ill., in charge of the design and sale of Ingersoll small tools.

HARNISCHFEGGER CORPORATION, Milwaukee, Wis., manufacturer of the P & H-Hansen arc welder, has presented to the Museum of Science and Industry in Chicago complete equipment, including a material-handling hoist, for a permanent exhibit of industrial welding.

Michigan

MAGNETIC MFG. Co., Milwaukee, Wis., has appointed GARRETT BURGESS, INC., 5050 Joy Road, Detroit, Mich., representative of the company in the Detroit territory. Garrett Burgess, Inc., will handle the entire Magnetic line, including Stearns high-duty magnetic separ-



I. H. Barbee, Head of Atlanta Plant of the Link-Belt Co.

ators, magnetic clutches, magnetic brakes, solenoids, and magnetic conveyor rolls.

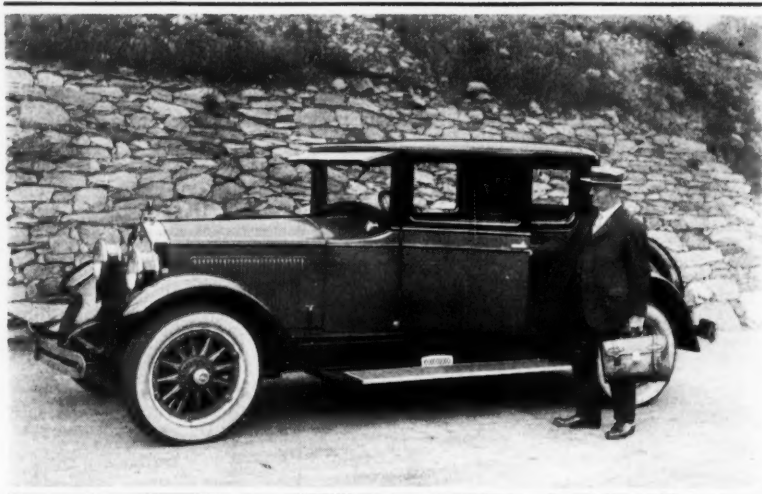
PUTNAM TOOL Co., 2981 Charlevoix Ave., Detroit, Mich., has recently been organized to engage in the manufacture of a line of "Hi-Speed" single and double end-mills, as well as a complete line of standard cutting tools. E. C. PUTNAM is president and sales engineer, and FRANK J. NEFSKE is general manager.

INTERNATIONAL NICKEL Co., INC., 67 Wall St., New York City, announces the removal of the Detroit district office of the Development and Research Department into larger quarters in the General Motors Bldg., Detroit, Mich.

New Jersey

EDGAR N. DOLLIN, formerly president of the Allied and Acme Die Casting Corporations, has formed a new corporation known as the DOLLIN CORPORATION to take over the die-casting divisions of the American Type Founders Co. and of the Lionel Corporation, including all the dies, equipment, and tools of the two organizations. The Dollin Corporation expects to locate its plant at Sager Place, Irvington, N. J. Mr. Dollin has been actively connected with the die-casting industry since 1912. WILLIAM GEBAUER, formerly chief engineer and production manager of the Allied Die Casting Corporation, will hold a similar position with the new corporation.

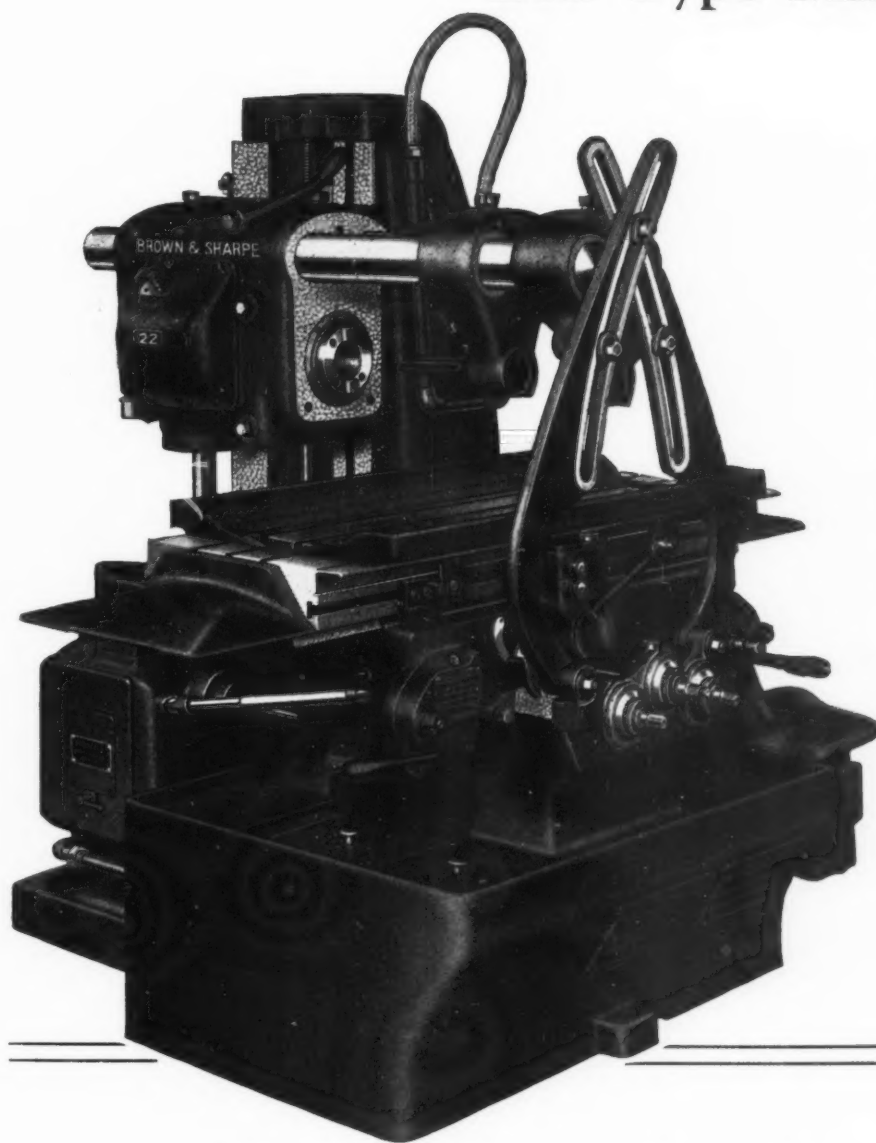
ELECTRO LIFT, INC., 30 Church St., New York City, manufacturer of mono-rail electric hoists and cranes, has recently moved into a new plant at Bloomfield, N. J., where ample manufacturing



Fred B. Smith, Who Has Just Completed Fifty Years of Association with the Hendey Machine Co.

No. 22 . . . a 2 in 1 Investment Giving—The Flexibility of Control of the “Column and Knee Design”

Combined with
the Production Advantages of the
“Bed Type Milling Machine”



Handy Control (as in the Column and Knee Machines) permits quick setups and reduces non-productive time on both short and long run jobs.

Unusual Rigidity (characteristic of the bed type) assures full productive efficiency with the maintenance of a high degree of accuracy.

Investigate its advantages!

Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.



BROWN & SHARPE

NO. 22 PLAIN MILLING MACHINE

facilities are available. These facilities provide not only for the manufacture of electric hoists, but also for the fabrication of hand and electric bridge cranes, jib cranes, and other types of cranes.

New York

HILAND G. BATCHELLER, president of the Ludlum Steel Co., Watervliet, N. Y., has been elected a director of the New York State National Bank, Albany, N. Y. Mr. Batcheller is also president of the Forging & Casting Corporation, Detroit, Mich., and of the Krupp Nirosa Co., New York City, and a director of the Canadian Atlas Steels, Ltd., Welland, Ontario, and of the Nitralloy Corporation, New York City.

TRIPLEX MACHINE TOOL CORPORATION, 125 Barclay St., New York City, has been appointed exclusive agent in the United States and Canada for the Société Genevoise d'Instruments de Physique, of Geneva, Switzerland. The line of equipment made by this company was for many years handled by the R. Y. Ferner Co., Washington, D. C. The present change has been made on account of the recent death of Mr. Ferner.

J. S. VANICK, of the Development and Research Department of the International Nickel Co., Inc., spoke on "Hardening of Cast Iron" before the York, Pa., chapter of the American Society of Metals, November 7; the Philadelphia chapter of the American Foundrymen's Association, November 14; and the American Society for Metals, at Rockford, Ill., November 19.

FRANK J. CONNOLLY has been appointed sales engineer for the New York office of the Allen-Bradley Co. located at 50 Church St., New York City. Mr. Connolly has had wide experience in the application of electric motor and control equipment and will be in charge of sales engineering in the Manhattan and Bronx territories. **C. N. CALKINS** is district manager.

Ohio

WHITLEY B. MOORE has been appointed general manager of the industrial division of the Timken Roller Bearing Co., Canton, Ohio. Mr. Moore was previously sales manager of the industrial division. **JOHN L. YOUNG**, until recently district general manager in charge of the Pittsburgh office of the company, has been advanced to the position of assistant general manager of the industrial division and will move to Canton, Ohio, to take over his new duties in the near future. **HARRY D. ROBB**, who has been with the company since 1925 on sales engineering work in various ter-

ritories, has been advanced to the position of district manager in charge of the Pittsburgh office, succeeding Mr. Young. **HARRY H. WOOD**, who has been on the engineering and sales staff in Canton since 1929, specializing in the application of Timken bearings in steel mills, has been transferred to Pittsburgh and appointed manager of the rolling mill division.

L. M. KLINEINST has been made vice-president in charge of sales of the Timken Roller Bearing Co., Canton, Ohio, and has also been elected a member of the board of the company. Mr. Klineinst has been associated with the Timken company for twenty-nine years, having held positions in both the manufacturing and selling divisions. Thirteen years ago, when the company started expanding into the industrial field, he was made general manager of the industrial division, and has been vice-president in charge of industrial sales since 1930.

CHARLES E. STUART, president and treasurer of the Tyson Roller Bearing Corporation, Massillon, Ohio, resigned on November 1, but will remain on the board of directors. **Russell E. Colgate**, chairman of the board, has been elected president and treasurer, succeeding Mr. Stuart. **RALPH H. MAXSON** is executive vice-president in charge of operations; **GEORGE C. McMULLEN**, vice-president in charge of sales; **GEORGE NEUPOWER**, secretary, and **E. R. EARNEST**, assistant treasurer and purchasing agent.

SIDNEY LANGSTON has been appointed representative of the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., in charge of the Cleveland territory. For the last seven years, Mr. Langston has been Cleveland district manager of the Kearney & Trecker Corporation, and was previously a member of the Pratt & Whitney sales office in that city. His headquarters will be at the Penton Bldg., Cleveland.

THE ENGINEERS CLUB of the Hoover Co., North Canton, Ohio, recently paid an inspection visit to the plant of the Warner & Swasey Co. in Cleveland, Ohio. The visitors, numbering nearly one hundred engineers, research men, designers and draftsmen, were shown step by step how turret lathes are manufactured and were told the story of the construction of the giant McDonald telescope now being built by the Warner & Swasey Co.

CHARLES H. REINERT, formerly superintendent of the Brooklyn plant of Steel & Tubes, Inc., has become assistant superintendent of the Electric Weld Tube Mill of the parent corporation—the Republic Steel Corporation, Youngstown, Ohio. **M. B. STEELE**, until recently a sales engineer connected with the Cleveland office of Steel & Tubes, Inc., is now assisting **E. T. Glass**, sales

manager of the New England division, with headquarters in Boston. Mr. Steele is a graduate of the Worcester Polytechnic Institute.

DURIRON Co., Inc., Dayton, Ohio, has made several changes in branch office management. **N. E. PHILPOT**, who has been manager of the Chicago office for several years, is assuming charge of the New York office, succeeding **W. E. PRATT**, who has resigned. **Colonel M. W. SMITH**, formerly manager at Buffalo, has been placed in charge of the Chicago office. **W. A. WATKINS**, formerly with the general sales department at Dayton has been made manager of the Buffalo office.

M. L. BETTCHER, formerly general superintendent of the Duriron Co., Inc., Dayton, Ohio, has been appointed gen-



M. L. Bettcher, New General Manager of the Duriron Co.

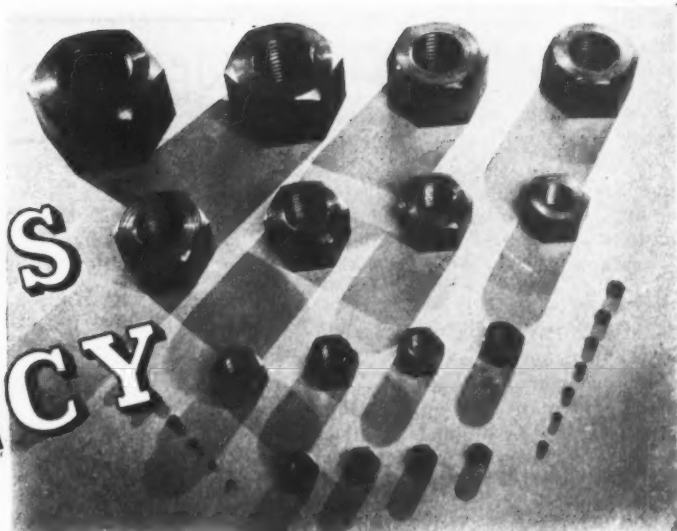
eral manager, succeeding **DUDLEY H. MILLER**, who becomes executive vice-president.

ROBERT J. WORKING has been appointed district sales manager in Cincinnati for the Republic Steel Corporation, Youngstown, Ohio, succeeding **W. A. PECK**. Mr. Working was formerly connected with the Central Alloy Steel Corporation, which was merged with the Republic Steel Corporation in 1930, at which time he was made assistant district sales manager of the Cincinnati office.

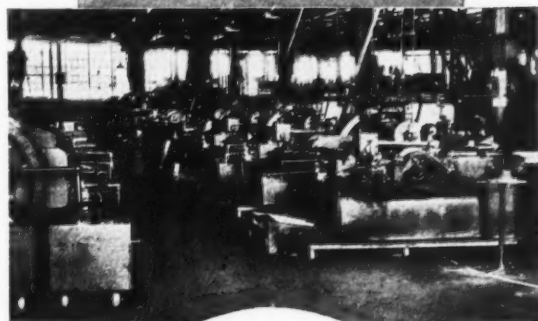
C. C. SNYDER, of the Republic Steel Corporation, Central Alloy Division, Massillon, Ohio, made an address entitled "Stainless Steel in the Dairy Industry" at a recent meeting of the Pittsburgh chapter of the Dairymen's Association. A number of display pieces of Enduro stainless steel were exhibited.

ALLSTEEL PRESS CO., 12015 S. Peoria St., Chicago, Ill., manufacturer of the Verson Allsteel line of punch presses and press brakes, has appointed the **MECHANICAL EQUIPMENT SALES CO.**, 416

SUNOCO'S EFFICIENCY



. . . As Shown in the Making of Empire Nuts



THE Coraopolis, Pa., plant of the Russell, Burdsall & Ward Bolt and Nut Company is well known. There are produced the widely used Empire nuts of every size, shape and style . . . nuts noted for their strength, fit and finish.

Machines Produce at Rated Capacity . . . With SUNOCO

In the R. B. & W. machines which cut the spool of steel, cold punch, chamfer, trim and burnish in one operation, a cutting lubricant of dependable performance is essential. This cutting oil must prevent overheating and drawing of the temper of dies, punches and cutters. It is significant that Sunoco Emulsifying Cutting Oil is chosen . . . and that these machines *produce at rated capacity*.

Smooth, Accurate Threads, Too

All day long (and frequently throughout the night) Sunoco does its part in the R. B. & W. nut tapping machines. And smooth, accurate threads are the result.

Aids Tools in Giving Best Service

In the manufacture of nuts, punch, die and tap life is most important. Time lost in resetting must be held to a minimum. The Russell, Burdsall & Ward Bolt and Nut Company find that with Sunoco, they secure long runs between tool settings, tool maintenance is reduced, and greater accuracy with better finish is obtained.

We suggest a trial of Sunoco in *your* plant — and under your own operating conditions. Your correspondence will have the prompt attention of our cutting oil engineers.

SUN OIL COMPANY
PHILADELPHIA - PA. - U. S. A.

SUNOCO

EMULSIFYING
CUTTING OIL

Chamber of Commerce Bldg., Cincinnati, Ohio, exclusive representative of the company in the Cincinnati district.

EDWARD NAGEL, who was connected for twenty years with the Chicago Pneumatic Tool Co., New York City, has become associated with the Master Tool Co., Inc., Cleveland, Ohio, and will have complete charge of the manufacturing of parts and the rebuilding of pneumatic tools.

NOBLE R. PATTERSON, who for the last eleven years has been associated with the International Harvester Co. at its Fort Wayne plant, has joined Aluminum Industries, Inc., Cincinnati, Ohio, manufacturer of Permite products, as sales engineer.

OBITUARY

George W. Drake, for forty years associated with the Warner & Swasey Co., Cleveland, Ohio, first as draftsman, and then as machine designer and mechanical engineer, died November 3, after a long illness. Mr. Drake was born in Massachusetts and became an apprentice with the Pratt & Whitney Co., Hartford, Conn., in 1880. After having completed his apprenticeship, he worked as a machinist and draftsman in Hartford for four years before going to Cleveland in 1888. Mr. Drake was a designer of many mechanisms for machine tools and obtained a number of patents. He was a frequent contributor to mechanical engineering journals.

NEW BOOKS

DIE-CASTINGS. By Herbert Chase. 264 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, \$3.50.

It has been the author's aim in writing this book, according to a statement made in the preface, to supply engineers, product designers, executives, students, and others interested in the metal-working arts with the latest information available on die-castings. To this end, he has outlined the commercial and technical possibilities of die-castings; set forth the characteristics of the various alloys suitable for die-casting; presented such information as is needed for the intelligent design of die-castings; prepared facts useful in the specification, inspection, and tests of die-castings; and furnished an outline of the types of finishes available for die-castings, including information on the preparation of the castings for finishing and on the methods used in the finishing process. Thus it will be seen that the book deals primarily with the product—its composition, uses, and design—rather than with the methods followed in its production, although some of the latter are briefly outlined. The book supplies information such as is needed by purchasers, including those in charge of design, production, and buying.

LUBRICATING OIL TESTS. By James I. Clower. 41 pages, 6 by 9 inches. Published by the Virginia Polytechnic Institute, Blacksburg, Va., as Bulletin No. 33 of the Engineering Extension Division Series.

COMING EVENTS

DECEMBER 3-7—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Engineering Societies Building, 29 W. 39th St., New York City.

DECEMBER 3-8—ELEVENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING at the Grand Central Palace, New York City. Manager, Charles F. Roth, International Exposition Co., Grand Central Palace.

JANUARY 5-10—NEW YORK AUTOMOBILE SHOW, at the Grand Central Palace, under the auspices of the Automobile Merchants' Association of New York, Inc. Alfred Reeves, show manager, Madison Ave. at 46th St., New York.

JANUARY 14-18—Annual meeting of the Society of Automotive Engineers to be held at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary, 29 W. 39th St., New York City.

MARCH 5-8—Fifth Packaging Exposition to be held at the Palmer House, Chicago, Ill., under the auspices of the American Management Association. The exposition will cover packaging, packing, and shipping. For further information, address Roberts Everett Associates, Inc., 232 Madison Ave., New York City, managers of the exposition.

JULY 15-20—International Congress for Scientific Management in London, England. For further information, address Industrial Development Association, British Empire Bldg., 620 Fifth Ave., New York City.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF MARCH 3, 1933,

of MACHINERY, published monthly at New York, N. Y., for October 1, 1934.

State of New York)
County of New York) ss.

Before me, a Notary Public, in and for the state and county aforesaid, personally appeared Edgar A. Becker, who having been duly sworn according to law, deposes and says that he is the treasurer of The Industrial Press, Publishers of MACHINERY, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Industrial Press, 140-148 Lafayette St., New York; Editor, Erik Oberg, 140-148 Lafayette St., New York; Managing Editor, None; Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; and Erik Oberg, 140-148 Lafayette St., New York.

2. That the owners of 1 per cent or more of the total amount of stock are: The Industrial Press, 140-148 Lafayette St., New York; Estate of Alexander Luchars, 140-148 Lafayette St., New York; Louis Pelletier, 140-148 Lafayette St., New York; Erik Oberg, 140-148 Lafayette St., New York; Robert B. Luchars, 140-148 Lafayette St., New York; Edgar A. Becker, 140-148 Lafayette St., New York; Laura A. Brownell, 140-148 Lafayette St., New York; Franklin D. Jones, 140-148 Lafayette St., New York; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; and Helen L. Ketchum, Atlantic Ave., Cohasset, Mass.

3. That there are no bondholders, mortgagees, or other security holders.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

EDGAR A. BECKER, Treasurer

Sworn to and subscribed before me this 28th day of September, 1934.

CHARLES P. ABEL,

Notary Public, Kings County No. 319
Kings Register No. 5120

(SEAL)

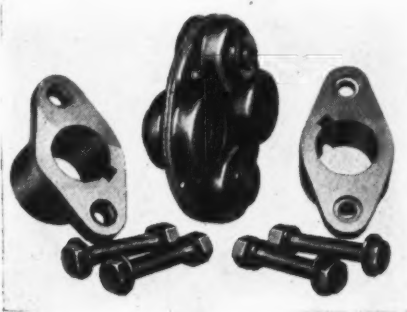
New York County No. 207. New York Register No. 5-A-128.
(My commission expires March 30, 1935)

POWER TRANSMISSION NEWS

Engineer or not, the person with a mechanical bent enjoys seeing a unit which has been developed and refined to the point where maximum efficiency is obtained with an utterly simple assembly.

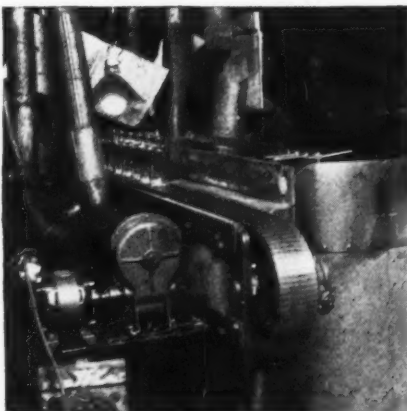
These are the chief characteristics of the Morflex Coupling, and are the reasons for its widespread use in many places.

Originally, it was developed as a universal joint to compensate for angular or parallel misalignment, and its adoption in many fields was rapid. It is now widely used in both automotive and marine service.



This illustration shows the simple assembly and the few parts which constitute this flexible coupling. The two forged steel hub members are mounted on the shafts to be connected; between these is carried the floating center, to which each hub is separately connected through a pair of resilient rubber trunnion blocks, which are set 90° apart under pressure into a 2-piece riveted housing of pressed steel. The blocks are molded over, and permanently fastened to steel cores or bushings. The outer section on the rubber block is a fabric ring, which holds it securely in the steel center. The shape of the rubber was carefully designed to give uniform stress and deflection throughout—an important feature which adds greatly to the life of the coupling.

The extreme flexibility of the unit is due to the resilient, non cold-flow rubber blocks—especially developed for this service. More than in any other coupling the design provides for misalignment and used in pairs Morflex is a perfect universal joint for shafts not in line.



The ingenuity which characterizes the products of the glass industry has been applied to a production problem in the plant of the Obeir-Nester Glass Co., East St. Louis, Illinois.

The problem was that of production-handling of hot bottles. Company engineers solved it by installing a Morse Silent Chain, connected to the drive shaft and an idler shaft—and it provides a perfect hot-bottle conveyor.

This unusual but entirely practical application of the Morse Silent Chain Drive employs a chain with $\frac{1}{2}$ " pitch and $4\frac{1}{2}$ " wide, traveling at a speed of 6 feet per minute.

Continuous operation for twenty years—that's the record of one Morse Chain.

Commenting on Morse Chains, this user says, "This chain is hooked up to a five-horsepower motor on a line shaft running thirty-eight machines. This chain has been in continuous operation for twenty years and the way it looks today, there is a possible chance of its running twenty more years. We use this type of drive exclusively in all our plants, scattered over the country. We believe this is the best and most efficient drive. We put a few drops of oil on these chains once a month and take up on the motor once a year, with no interruption or loss of time."

ALWAYS USE

Chain Drives

**FLEXIBLE
NON-SLIPPING
NO POWER LOSS
LONG LIFE
ADAPTABLE
LOW COST**

MORSE engineers will give you information on the specific application of chain drives to your transmission needs.

MORSE CHAIN COMPANY
DIVISION OF BORG-WARNER CORPORATION
ITHACA · NEW YORK

Classified Contents of this Number

DESIGN, FIXTURE AND TOOL

| | |
|--|-----|
| Fewer Sizes of Milling Cutters | 212 |
| Die Designed to Make Right-Angle Bends at Ends of Formed Parts— <i>By L. Kasper</i> | 227 |
| Chamfering Tool for Inaccessible Work | 228 |
| Gage for Inspecting Taper Holes— <i>By C. W. Putnam</i> | 228 |
| Jig with Floating V-Block for Centering Work— <i>By Phil E. Veraa</i> | 229 |
| Removable Jig Cover for Drill Bushings | 229 |
| Pilot for Pressing in Thin-Walled Bushings— <i>By J. E. Fenno</i> | 229 |
| Indexing Fixture of Electrically Welded Con- struction— <i>By O. S. Marshall</i> | 230 |

DESIGN, MACHINE

| | |
|---|-----|
| The Gearmotor and its Possibilities— <i>By S. B. Brittain</i> | 209 |
| Mechanism for Oscillating a Part Mounted on Moving Members— <i>By A. R. Kligman</i> | 219 |
| Cam of Small Diameter for Imparting a Long Stroke with a Rapid Return— <i>By J. E. Fenno</i> .. | 220 |
| Device that Prevents Engagement of Clutch until Slide is in Operating Position— <i>By F. E. Judson</i> | 221 |
| Bearing Pressures | 232 |

HEAT-TREATING PRACTICE

| | |
|---|-----|
| Heat-Treating in an Automobile Plant— <i>By J. B. Nealey</i> | 201 |
| Selecting Carburizing Boxes | 226 |
| Hardening Corrosion-Resistant Steels with Dry Ice | 232 |
| Heat-Treatment of Cobalt High-Speed Steel— <i>By William C. Betz</i> | 233 |

LUBRICATION METHODS

| | |
|--|-----|
| Production Engineers Would Welcome Information on Cutting Oils | 218 |
| Greater Tool Life by Efficient Lubrication | 231 |
| Centralized Lubrication of Industrial Machinery— <i>By T. R. Thomas</i> | 238 |

MANAGEMENT PROBLEMS

| | |
|--|-----|
| Can Trade Secrets be Legally Protected?— <i>By A. H. Rodrick</i> | 206 |
| Patent Applied for Under an Assumed Name— <i>By Leo T. Parker</i> | 232 |
| Adequate Lighting in Machine Shops | 240 |

MATERIAL-HANDLING METHODS

| | |
|--|-----|
| Electric Trucks for Handling Heavy Dies | 208 |
| Handling Heavy Dies with a Mechanical Stacker— <i>By Francis A. Westbrook</i> | 231 |

MATERIALS, METALS, AND ALLOYS

| | |
|--|-----|
| Brass Alloys that can be Die-Cast | 211 |
| Nickel Steel for Railroad Service | 212 |
| Weldability is Now an Important Quality in Steel | 218 |
| Why Nickel-Chromium Alloys are Used for Electrical Heating Elements | 236 |
| Phosphor-Bronze and Nickel Silver with Free- Cutting Properties | 236 |
| Alloy Cast Iron Greatly Lengthens Life of Cylinders and Pistons | 236 |
| Copper-Silicon Product Specifications Approved by A S T M | 237 |

MEETINGS, CONVENTIONS, AND EXPOSITIONS

| | |
|---|-------|
| Packaging Machinery Manufacturers Institute Elects Officers | 225 |
| International Acetylene Association Meets | 240 |
| Exhibition of Inventions | 240 |
| Eleventh National Exposition of Power and Mechanical Engineering | 264-A |

NATIONAL INDUSTRIAL RECOVERY

| | |
|--|-----|
| Improved Machinery the Road to Business Activity | 205 |
| Connecticut Manufacturers Propose a Platform for Industry | 210 |
| The President's Unique Opportunity to Achieve Real Recovery | 218 |

NEWS OF THE INDUSTRY

| | |
|---|-------|
| Engineering News Flashes | 216 |
| Soviet Purchases in Great Britain | 221 |
| National Automobile Chamber of Commerce Changes Its Name | 230 |
| Reinecker Celebrates Seventy-Fifth Anniversary .. | 240 |
| News of the Industry | 264-B |

SHOP PRACTICE

| | |
|--|-----|
| Multiple Machining and Economy—A Comment— <i>By H. B. Gardner</i> | 207 |
| A Weighing Scale that Automatically Records Weights | 212 |
| Tungsten Carbide Reduces Tool Sharpening— <i>By Charles O. Herb</i> | 213 |
| Progress in Machine Shop Practice | 215 |
| Multiple-Station Drilling on Small-Lot Produc- tion— <i>By David M. Strauchen</i> | 222 |
| Shop Equipment News | 243 |

WELDING PRACTICE

| | |
|--|-----|
| Organized Courses in Electric Welding | 207 |
| Warping and Deformation of Welded-Steel Machinery Parts— <i>By W. T. Davidson</i> | 234 |



He's Shoveling Away DOLLARS - - - You'll Never Get Back!

EVERY pound of machining scrap takes its toll in profits gone forever! Wasted machining time! Lost profits on salable parts this time represents! Wasted foundry dollars! Wasted tools!

Here indeed is a golden opportunity to do some substantial cost-cutting! And here is a simple, practical way to do it:

Order your next lot of castings with just enough surplus metal to provide for a light cut *just under the scale!* Then put Carboloy tools on this ordinarily difficult job! Not only will Carboloy easily take a light cut—skim cut if necessary—through that hard, tough scale, but it will do the job at higher speeds and stand up for long periods between grinds . . .

. . . you'll save metal, machining time, tool cost, and increase your profit margin on every casting machined! This and other advantages of Carboloy tools are described in our latest booklet, "The Profitable Use of Carboloy Tools". Sent free to production executives, upon request.

CARBOLOY COMPANY, INC.
DETROIT, MICHIGAN

CHICAGO — CLEVELAND — PHILADELPHIA — NEWARK — PITTSBURGH

CARBOLOY

CEMENTED CARBIDE TOOLS

COMPLETE INFORMATION
ON THE PROFITABLE USE
of CARBOLOY

CARBOLOY
TOOLS WILL
HELP YOU SAVE
"SCRAP-PILE"
DOLLARS

 The Mark of Carboloy
Carboloy Company, Inc.,
2987 E. Jefferson Ave., Detroit, Mich.
We are interested in increasing our profit margin.
Send us your free 24-page booklet, "The Profitable Use of Carboloy Tools".

Name _____
Company _____
Street _____
City _____
State _____
Title _____

JULY 15-20—INTERNATIONAL CONGRESS FOR SCIENTIFIC MANAGEMENT in London, England. For further information, address Industrial Development Association, British Empire Bldg., 620 Fifth Ave., New York City.

SEPTEMBER 11-21—MACHINE TOOL EXPOSITION to be held in Cleveland, Ohio, under the auspices of the National Machine Tool Builders' Association,

1220 Guarantee Title Bldg., Cleveland, Ohio.

SEPTEMBER 30-OCTOBER 4—NATIONAL METAL EXPOSITION AND CONGRESS under the auspices of the American Society for Metals to be held in the International Amphitheatre, 43rd and Halsted Sts., Chicago, Ill. W. H. Eisenman, secretary, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

NEW BOOKS AND PUBLICATIONS

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1935). 4800 pages, 9 by 12 inches. Published by the Thomas Publishing Co., 461 Eighth Ave., New York City. Price, \$15.

Purchasing agents, sales managers and other executives who require lists of manufacturers of various products will welcome the 1935 edition of this comprehensive directory of American manufacturers, which has become an invaluable aid in many different lines of industry. The book covers all manufactured products in the United States.

As in the previous editions, the arrangement is such that the desired information can be quickly and conveniently obtained. The various sections are printed on different colored paper, so that they can be easily found. Manufacturers are listed both according to product and to geographical location.

The Classified Products Section (printed on white paper), which comprises the main part of the book, covers 3638 pages. In addition to this section, there is an alphabetical list of manufacturers, together with their addresses (printed on blue paper), so that if one knows the name of a manufacturer and desires to find out what his product is, the information can be readily obtained. This list includes home and branch offices, and in many cases the names of officers of the concern.

A third important section is that containing an alphabetical list of the trade names of the various products covered (printed on pink paper). A comprehensive index or "finding list" is included. Other supplementary lists given in the appendix cover representative banks, boards of trade, chambers of commerce and similar commercial organizations, and trade papers.

A new feature of the book is an index of the new developments or products that have been brought out during the previous year (1934), together with the name and address of the manufacturer and reference to the issue of "Industrial Equipment News" (a monthly supplement to the Directory) in which these products were described.

BUDGETING. By Prior Sinclair. 438 pages, 6 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, \$5.

In view of present industrial conditions, this new book on budgeting is of timely interest. Every business has the immediate problem of devising some plan that will enable it to operate successfully under existing circumstances. Effective budgeting is believed to be an important aid in solving the problem. As stated in the preface, the aim of the book is comprehensiveness. It treats budgeting in its full scope, not merely as a matter of mechanical routine or as a phase of accounting, but more broadly as a plan of practical business management. It has also been the aim to avoid theoretical methods and present only those that have been proved by practice.

An idea of the scope of the book will be obtained from the following list of chapter headings: Business Planning; Essentials of Budgeting; Master Budget; Financial Budget; Estimated Balance Sheet; Estimated Profit and Loss Statement; Sales Budget; Production Budget; Materials Budget; Purchase Budget; Labor Budget; Manufacturing Expense Budget; Selling Expense Budget; Advertising Expense Budget; Management Expense Budgets; Plant and Equipment Budget; Retail Merchandise Budget; Budget Manual; Budget Analysis; Profit Realization Chart; and Budget Reports and Charts.

INDUSTRIAL ELECTRONIC TUBES. 217 pages, 8 1/4 to 10 3/4 inches. Published by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Price, \$2.25.

This pamphlet contains fundamental facts on the operation and application of electronic tubes in industry. The material is arranged in the form of lessons divided into various assignments. The treatment is non-mathematical. The purpose throughout is to show how electronic tubes can be put to practical use in industrial manipulation and control. A supplement to the above course, under the title "Manual of Experiments," has also been brought out at a price of

65 cents. This consists of a series of twenty-four tests demonstrating the types and characteristics of the various electronic tubes described in the pamphlet previously referred to. It explains the apparatus needed, method of set-up, procedure, and results to be obtained.

THE INTERNAL COMBUSTION ENGINE (VOL. II). By D. R. Pye. 398 pages, 6 by 9 inches. Published by The Oxford University Press, 114 Fifth Ave., New York City. Price, \$7.

This is the second volume of a work on the internal combustion engine. The first book dealt with the basic principles of combustion and thermal efficiency in all types of internal combustion engines, while the present book discusses the aero-engine particularly, carrying on the same method of treatment in dealing with the problems to be faced by the designer of aero-engines or other engines of high output. Chapters are devoted to the principles of air cooling and of superchargers, and the operation of supercharged engines, carbureters, lubrication, and lubricants. A valuable feature of this book is the chapter on the airplane and its power plant, written by W. S. Farren.

EFFECTS OF McQUAID-EHN GRAIN SIZE ON THE STRUCTURE AND PROPERTIES OF SAE 1040 STEEL. 16 pages, 8 1/2 by 11 inches. Distributed by the Carnegie Steel Co., Pittsburgh, Pa.

This booklet discusses generally the different characteristics and properties of grain-size controlled steels. It supplements the data presented in the book entitled "Carnegie Controlled Carbon Steels." The booklet discusses SAE 1040 forging steels and illustrates the widely different characteristics and properties of steels of inherently coarse and fine grain types. The influence of mixed grain structure on the physical properties and the desirability of a uniform structure at the heat-treating temperatures are clearly demonstrated.

CALENDARS

Calendars for 1935 have been received from the following concerns:

UNITED ENGINEERING & FOUNDRY Co., Pittsburgh, Pa.

GENERAL ELECTRIC Co., Schenectady, N. Y.

LINK-BELT Co., 910 S. Michigan Ave., Chicago, Ill.

NEW DEPARTURE MFG. Co., Bristol, Conn.

HYATT ROLLER BEARING Co., Newark, N. J.

CINCINNATI MILLING MACHINE & CINCINNATI GRINDERS, INC., Cincinnati, Ohio.

POWER TRANSMISSION NEWS

Eleven years of constant, trouble-free service of a Morse silent chain drive is reported by a rope manufacturer. Moreover, this veteran had no easy job. It was used on a "softener," which breaks down or softens raw sisel, which, as any rope man will tell you, is unusually hard service.

However, the Morse drive performance was so impressive that another was purchased recently for the same type of service. This company now operates about 400 Morse silent chain drives in its plant.

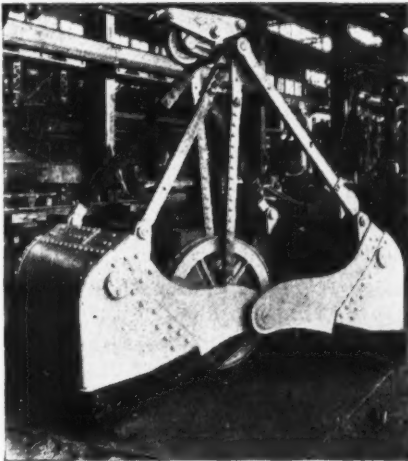
Improved Free Wheeling Clutch

The Morse Improved Kelpo Clutch is a positively actuated one-way clutch, free-wheeling in one direction, but driving in the other. Operating with no back-lash, it is ideal as a ratchet drive. Used to connect two prime movers to a common load, either will pull the load but neither can drive the other. This dual drive finds frequent application for two motors or motor and turbine driving force or induced draft fans, for auxiliary stand-by drive, and for booster drives for starting heavy

machines such as printing presses, paper mill and steel mill machines.

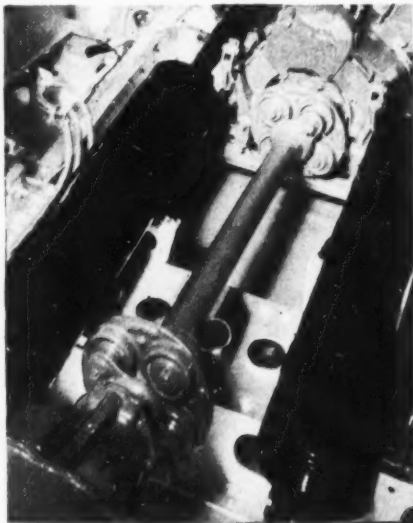
Suitable for all speeds up to 3000 r. p. m., the Morse Improved Kelpo Clutch is perfectly balanced and unaffected by centrifugal force. It is filled with light oil, and fitted with felt grease seal to retain the lubricant.

Morse Improved Kelpo Clutch is simple in design and of rugged construction. It is built of fine alloy steels, hardened and ground to exceptionally close limits of accuracy, and its exclusive feature is automatic compensation for wear.



**Operates Clamshell
Bucket**

A Special Adaptation of Morse Silent Chains is used to operate Clamshell Bucket. Three-inch pitch guide link chains offset to wrap around shaft when closing bucket—special end links for attaching. Tensile strength 96,000 lbs. per chain.



Morflex Couplings

Looking up we see two Morflex couplings used as universals on the White Truck powered with White Pancake Engine. Morflex couplings are continually being used to transmit power under severe service conditions.

USE MORSE

Roller Chains

Improved design gives smoother running, quieter operation, longer life. Lubrication reaches every part of chain. A Morse product already proved and accepted by industry as a better engineered and better built roller chain.

Ask for Morse Bulletin No. 51—a complete data book on Roller Chains.

MORSE CHAIN COMPANY

DIVISION OF BORG-WARNER CORPORATION
ITHACA · NEW YORK

Classified Contents of this Number

DESIGN, FIXTURE AND TOOL

- Jig for Drilling Cross-Head Guide—
By C. W. Putnam..... 357
- Arbor Press Fixture for Pressing in Thin-Wall
Bushing..... 357
- Jig Boring Tool for Milling Machine and Lathe—
By Avery E. Granville..... 358

DESIGN, MACHINE

- Mechanisms for Controlling Lead-Screw Feeds—
By M. A. Hollengreen..... 337
- Mechanism for Reversing Rotation of Shaft after
One Complete Turn..... 347
- Mechanism that Causes a Slide to Dwell During
Every Other Cycle—By J. E. Fenno..... 347
- Mechanism for Keeping Top Sheet of Stack in
Line with Feed-Rolls—By F. E. Judson..... 349

DIEMAKING, DIE DESIGN, AND PRESS WORK

- Advanced Die Design Extends the Field of Die-
Casting—By Charles O. Herb..... 329
- Combination Die for Piercing and Slotting Angle-
Bars—By R. B. Berg..... 355
- Die for Cold-Forming Key on Shaft—
By H. R. Schmidt..... 358

HEAT-TREATING METHODS

- Electric Attachment for Annealing Metal Strip as
it is Fed to the Die..... 341
- What a Shop Executive Should Know about the
Heat-Treatment of Cutting Tools—
By Robert C. Deale..... 350
- Heat-Treatment of Heavy Hammer Dies..... 359

MANAGEMENT PROBLEMS

- How to Provide Better Lighting in Machine Shops 352
- Liability of Builder for Accidents Due to Defects
in Machinery of His Manufacture—
By Leo T. Parker..... 359
- Can We Establish Equitable Conditions in In-
dustry?—By C. R. Rosborough..... 362
- Formulas for Estimating Milling Machine Produc-
tion—By Joseph Olson..... 364

MATERIALS, METALS, AND ALLOYS

- The Increasing Application of Hard-Facing..... 335
- The Part Stainless Steel Plays in the New Auto-
mobiles..... 368
- Molded Plastics that Meet the Demand for High
Impact Strength..... 368
- A Surfacing Material for Repairing Shop Floors. 368

- An Alloy Steel Developed Especially for Bakelite-
Product Molds..... 368
- Koroseal—a Rubber-Like Material that Does Not
Softens in Oil..... 369
- Laytex—a New Insulation for Electricity..... 369
- Pancake Bus Engines Made of Nickel-Chromium
Cast Iron..... 369

MEETINGS AND EXPOSITIONS

- Automotive Engineers Celebrate Thirtieth Anni-
versary..... 363
- Seen at the Olympia Exhibition..... 366

NATIONAL INDUSTRIAL RECOVERY

- Prospects in the Machine Tool Industry..... 343
- Where New Equipment is Needed..... 343
- Code Restrictions on Machinery and Production.. 346
- The Right Road to Recovery..... 360
- There is Plenty of Business Ahead in the Machin-
ery Field..... 361
- Machinery and Allied Products Institute Prepares
to Measure Pent-Up Business..... 370

NEWS OF THE INDUSTRY

- Census of Machine Tool Accessories and Machin-
ists' Tools..... 336
- Industrial Conditions in Great Britain..... 354

SHOP PRACTICE

- Sensitiveness of Anti-Friction Bearings..... 343
- Lathe for Producing Microscopic Laps and Dies—
By Sten Wadsten..... 353
- Relieving Gage Surfaces to Compensate for Com-
pression of Fastening Screws—
By Jack Finlay..... 356
- Bearing Failures in Wick-Lubricated Motors.... 359
- Correct Procedure in Straightening Broaches.... 359
- The Scrap Heap Yields a Machine for Riveting
Piston Bull-Rings—By Oliver Herbert..... 361
- Single-Point Boring of Cylinders..... 365
- The Measuring of Surface Finish..... 371
- A Convenience for Handling Oil Barrels in the
Shop..... 374
- Shop Equipment News..... 375
- X-Ray Inspection Equipment in a Steel Foundry. 387

WELDING PRACTICE

- Steel Castings in Welded Structures—
By R. H. Longbottom..... 340
- Roll-Welding High-Pressure Steam Pipe—
By George H. Hall..... 342
- Weld-O-Meter Gives Useful Welding Facts..... 387

SHOP EQUIPMENT SECTION

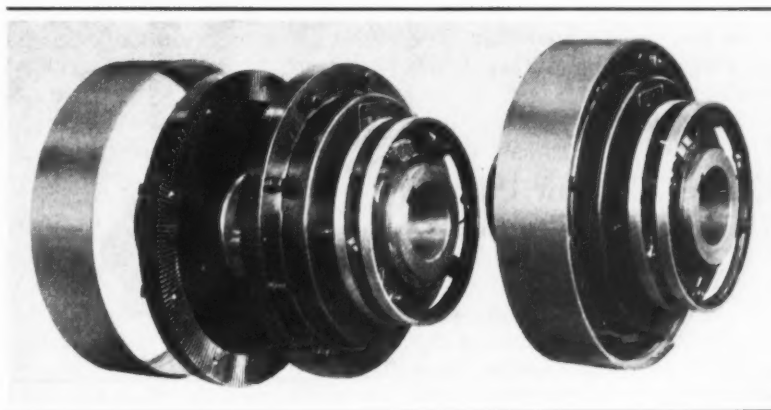
the line of products manufactured by the Rickert-Shafer Co., Erie, Pa. Rubber V-type endless belts are used for transmitting the drive from the motor to the machine. This gives a non-slipping drive that operates noiselessly.

This tapping unit is manufactured in two sizes, with capacities for driving 3/16- and 5/16-inch standard taps in steel.

Positive-Engagement Magnetic Clutch

A magnetic clutch that drives by means of crown teeth cut near the outer edge of two members, thus insuring positive engagement, has recently been developed by the Magnetic Mfg. Co., Milwaukee, Wis. This clutch is capable of transmitting high torque loads at high speeds. Engagement or disengagement of the clutch members should be made with the unit standing still or operating at a very low speed so as to prevent injury to the teeth. The clutch is released by means of spring pressure. Quick engagements and disengagements are obtainable.

An outer shell can be provided, as shown, to shield the teeth from grit and dirt which would interfere with engagement of the clutch members. The clutch can be built in a number of sizes, the unit illustrated being approximately 20 inches outside diameter.



Magnetic Clutch with Crown Teeth that Insure Positive Engagement

Baldor Ball-Bearing Buffers

A line of bench and pedestal type buffers that includes sizes from 1/3 to 5 horsepower is being placed on the market by the Baldor Electric Co., 4357 Duncan Ave., St. Louis, Mo. These machines are equipped with large-sized ball bearings that are entirely enclosed in extended end-bells of the motor. The motor is dynamically balanced to eliminate vibration, and is pro-



Pedestal Buffer of the Ball-bearing "Handy" Line

vided with a heavy wheel shaft. The distance between wheel centers ranges from 20 3/4 inches to about 28 inches, with different machine sizes. The speed is either 1725 or 3450 R.P.M.



Plating Barrel Constructed of Steel and Shock-resisting Rubber

Udylite Plating Barrel

A plating barrel that is intended for use with alkaline and acid plating solutions and is constructed of steel and shock-resistant rubber has recently been developed by the Udylite Co., Detroit, Mich. The cylinder consists of a framework of steel into which rubber rails and heads are fitted. The entire steel framework is anodically charged so that it will not become plated.

Rubber was chosen as the insulating material for the panels, rails, and heads because it does not disintegrate by absorbing the plating solution and will resist wear to a high degree. The insulation provided on this barrel insures that all of the electric current will go directly to the work. The cathode lead is encased in continuous, unbroken insulation from the contact pins to the dangle arbor. The cast-iron hanger from which the cylinder is suspended is not integral with or a part of the cathode lead, so that strains in the hanger have no effect on the lead and do not cause its covering to crack.

The bearing on which the cylinder revolves is anodic and is separate from the cathode lead. The rails are made of solid rubber and do not encase either the cathode lead or a steel reinforcement. Consequently, there is no metal in the rails to expand and open up joints or crack the rail. These various features are said to eliminate all possibility of "treeing."



Standard Closures and Covers
for Anti-friction Bearings

Complete Ball- and Roller-Bearing Housing Closures

Complete closures for approximately 150 sizes of ball and tapered roller bearings are now made by the Bearing Appliance Co., Ardmore, Pa., in a number of types to suit many design combinations. These closures are finished, ready for use. Typical styles are shown in the accompanying illustration.

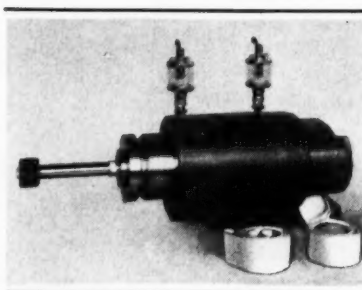
Standard bolt-fastening dimensions have been established. For each group of bearings having similar diameters, there are a number of parts available, all of which have identically located holes. Fourteen sizes of cast-iron covers which completely enclose the bearing housings, as well as open covers of various types, are included in the line. Among the latter are covers equipped with felt, covers provided with flingers, and covers designed to accommodate standard leather or composition oil seals.

Various amounts of inside space can be provided to permit the mounting of bearings with or without lock-nuts in fixed or floating positions and with proper abutting shoulder diameters. Some parts are fitted with lubricating and cleaning openings to eliminate the expense of providing holes in the main housings.

B & S Ball-Bearing Internal Grinding Fixture

Belt- and motor-driven Nos. 2, 3 and 4 universal grinding machines built by the Brown & Sharpe Mfg. Co., Providence, R. I., may now be equipped with the No. 42 ball-bearing type of internal grinding fixture here shown. The spindle of this fixture runs at 12,000 revolutions per minute in ball bearings adjusted to a constant predetermined load. This construction automatically compensates for any expansion due to heating or for any contraction.

The wheel-arbor is seated on a taper and is held in the spin-



Ball-bearing Internal Grinding
Fixture for B & S Machines

dle by its threaded end. Various wheel-arbors are available up to 1 inch in diameter and 5 inches in length. The smallest diameter arbor enables holes to be ground down to 9/16 inch in diameter. An endless canvas belt, which is readily changed and adjusted, drives the spindle smoothly. The net weight of the fixture is 90 pounds.

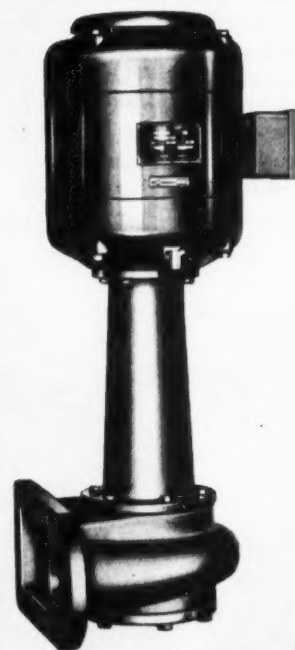
Gusher Coolant Pump Designed to Eliminate Piping

A coolant pump designed to do away with piping around the outside of machine tools has just been brought out by the Ruthman Machinery Co., 534 E. Front St., Cincinnati, Ohio. This Model 11027 pump, here illus-

trated, can be installed on a machine by merely using five cap-screws. No pipe, hose, or tubing is required to be connected to the pump.

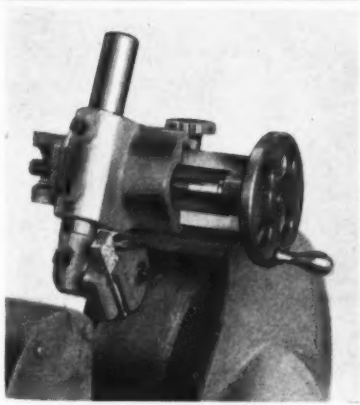
The intake supply of coolant flows by gravity into the pump through an opening provided in the pad mounted on the side of the machine. It is intended that a delivery pipe be connected to the inside wall of the reservoir in line with the discharge opening in the pump. This pipe can be fastened to the inside of the machine either by threading, calking, or expanding.

The pump operates in a vertical position and is driven by a built-in motor. It embodies all the features of the regular line of Gusher coolant pumps made by the concern. However, it is believed to be the largest pump ever built in the out-of-reservoir type for supplying coolant to a single machine tool. Equipped with a one-horsepower motor running at 1725 revolutions per minute, the pump has an output of approximately 150 gallons of coolant a minute.



Coolant Pump which Eliminates
Piping on the Outside
of a Machine

SHOP EQUIPMENT SECTION



Grinding-wheel Dresser Made by the Production Machine Co.

Wheel Dresser for Polishing and Grinding Machines

An abrasive wheel-truing device consisting primarily of a slide that is adjustable along the ways of a hinged bracket, is being introduced to the trade by the Production Machine Co., Greenfield, Mass. The diamond, abrasive stick, or other medium to be used for dressing the wheel is held by an adapter which, in turn, is mounted on the slide. This adapter can be turned on its axis to bring the dresser to any desired angle in relation to the wheel. The shank of the adapter can be adjusted vertically in its bearings.

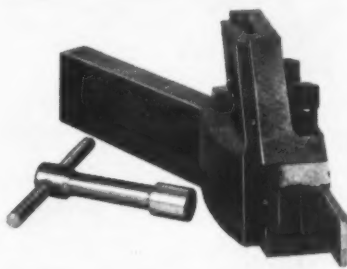
As will be apparent from the illustration, the dresser is fed across the abrasive wheel by turning a handwheel, which moves the slide of the unit along the horizontal ways of the bracket. The bracket has a long arm extending toward the back of the wheel guard, where it is trunnioned in two lugs of the guard. When the dresser is not in use, the entire device can be swung back on its trunnions out of the operator's way. A simple clamping arrangement provides for locking the unit securely in the forward or dressing position.

When a cloth wheel is to be trued before the application of abrasive, a knife can be mounted in the adapter in place of the diamond or abrasive stick.

Wells Universal Cutting-Off Tool

Several improved features are claimed for a cutting-off, turning, threading, and forming tool being placed on the market by the Wells Mfg. Co., 6239 King Ave., Bell, Calif. As will be seen from the illustration, the cutter-holder is supported from above, which gives the tool the same action as that of the regular spring type. However, more rigidity is provided.

The cutter can be adjusted vertically and tilted sidewise for clearance by applying a wrench after the shank has been clamped in the toolpost of a lathe. All tools can be ground without



Wells Cutting-off, Turning, Forming, and Threading Tool

changing their setting. The shank, holder, and screws are made of chrome-molybdenum steel and are heat-treated. This tool is made in four shank sizes ranging from 7/8 by 3/8 inch up to 1 5/8 inches by 3/4 inch.

Barrett Multiple-Stroke Lift Truck

A slide type of lift mechanism is one of the features of a multiple-stroke lift truck that is being placed on the market by the Barrett-Cravens Co., 3255 W. 30th St., Chicago, Ill. This truck is made in two widths, 18 and 25 inches, and each width is built in capacities of 3500 and 6000 pounds. All four models of the trucks are made in a range of lengths and with different wheel diameters.

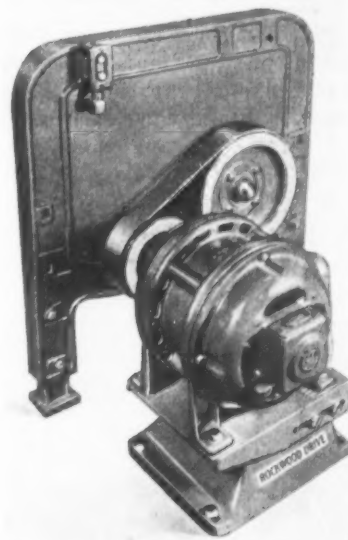


Barrett Multiple-stroke Slide Type Lift Truck

With the slide type of lift, each stroke of the handle is made with the same lifting effort. Ball bearings provide for easy rolling of the wheels and take care of side thrusts in turning corners. A helical type of release check is provided which carries four times the oil that is needed with single-stroke trucks.

Recent Rockwood Drives

The wide application in various industries of the drives produced by the Rockwood Mfg. Co., Indianapolis, Ind., has been em-



Rockwood Drive Designed Specifically for an Application in the Textile Industry

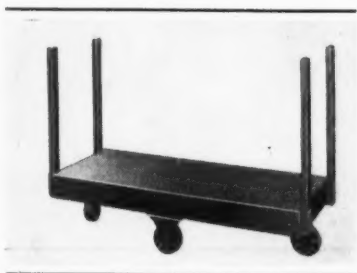
SHOP EQUIPMENT SECTION

phasized by the recent development of three new drives specifically for use on spinning frames in the textile industry. The base here shown is so constructed that the motor is 8 inches above the floor. Simple adjustments made when the drive is installed on a machine suffice to establish the correct belt tension and pulley alignment. The weight applied by the pivoted motor insures a uniform transmitting capacity throughout the life of the drive and the desired speed of the driven pulley.

In the second type of drive developed for spinning frames, a pivoted motor base is recessed in a shelf of welded steel. The motor is 8 inches above the floor in this design also. In the third Rockwood spinning-frame base, the motor is mounted above the driven pulley so as to provide maximum clearance over the floor and to permit a wide selection of pulley sizes, belt lengths, and driven speeds. The correct belt tension is maintained by springs located beneath the motor shelf. This drive is reversible without requiring changes or adjustments.

Stackbin All-Steel Platform Trucks

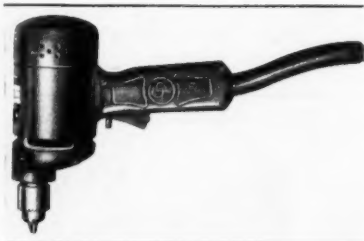
Platform trucks now being placed on the market by the Stackbin Corporation, Providence, R. I., are constructed of one piece of heavy sheet steel, formed into an inverted box section with the under sides also formed inward and reinforced by 4-inch steel channel struts.



Platform Truck Constructed Entirely of Steel

These parts are electrically welded together, so as to produce a unit that will retain its rigidity under any load.

Casters of the pressed-steel body type are used. They are welded to the under side of the chassis, so that it is impossible for them to loosen. Either rubber-tired ball or roller casters are supplied, as well as thread guards. The standard stakes provided with these trucks are made of 2- by 1/2- by 1/8-inch channel iron, and they are 27 inches long. The trucks are finished in a battleship-gray enamel that is baked on.

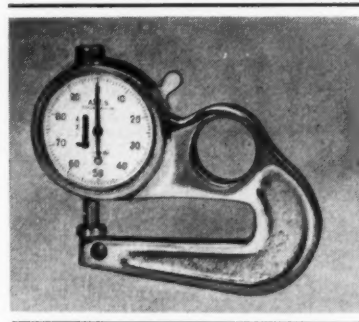


Chicago Pneumatic Drill for Holes up to 3/16 Inch in Diameter

C. P. Universal Electric Drill

Holes up to 3/16 inch can be drilled in light metal and wood, as in the construction of airplanes, automobile bodies, metal furniture, steel shelves, and steel filing cabinets, by a No. 815 universal electric drill recently brought out by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City. This drill has a weight of only 4 pounds and an over-all length of 7 1/2 inches. It is available in two models, one of which has a free speed of 5000 revolutions per minute and the other of 3700 revolutions per minute.

The ventilation exhaust is directed toward the work, away from the face of the operator. Dirt and chips are screened from the intake. The drill is of unusually accessible design, it being possible to inspect the commutator and brushes while the motor is running. Ball bearings are provided throughout.



Gage for Measuring Sheets as Far as 2 Inches from Edges

Ames Pocket Gage with Two-Inch Throat

Steel sheets can be measured for thickness as far as 2 inches in from the edge with a deep-throat pocket gage now being placed on the market by the B. C. Ames Co., Waltham, Mass. The 2-inch diameter dial provided on this gage is graduated to indicate thousandths of an inch. However, the graduations are spaced widely enough apart so that finer measurements can be easily estimated. A chart attached to the back of the gage gives fractions and decimal equivalents.

Quickness of operation is a feature of this gage, as the anvils are opened by simply pressing down a lever on top of the frame. The anvils are closed by a uniform spring tension, which is applied automatically when the lever is released. Sheets up to 5/16 inch thick can be measured.

The frame of this gage is made of bronze and is chromium-plated. Other parts are also rustless. As the gage weighs only 7 ounces, it can be conveniently carried in the pocket.

P & H-Hansen Vertical Welders

A 50-ampere vertical welder was recently developed by the Harnischfeger Corporation, Milwaukee, Wis., to provide a low-current arc welder capable of handling the lighter gage metals used in automobile body build-

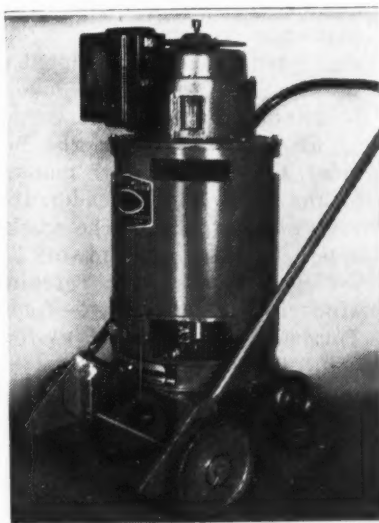
SHOP EQUIPMENT SECTION

ing. Steels down to No. 26 gage can be accommodated because of the stable high-speed arc which the equipment provides. The arc is stabilized through an internal winding.

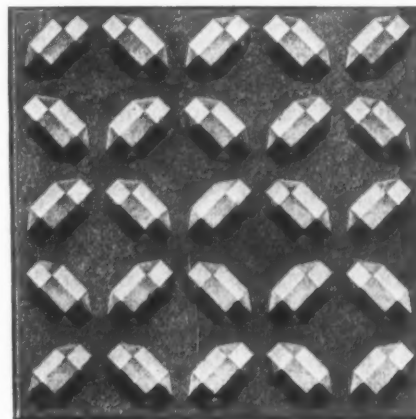
Equipped with a motor-generator unit, this welder operates on any alternating-current power line, including 110-volt, single-phase. A three-horsepower, squirrel-cage motor is standard equipment. The current is simply controlled through a single-adjustment dial on top of the

housing; thus the equipment is also adapted for welding ferrous and non-ferrous metals in general repair work or for the fabrication of containers from stainless steel, phosphor-bronze, aluminum, etc., with the metallic arc.

The welder can be supplied with wheels, as shown, with a base designed for stationary mounting, or with a lifting bail for easy handling about the shop.



Low-current Arc Welder of Vertical Construction



Pattern of Multigrip Floor Plate—Half Size

Multigrip Floor Plate

Steel floor plate known as "Multigrip" is being introduced on the market by the Illinois Steel Co., 208 S. LaSalle St., Chicago, Ill. This plate was designed to provide maximum resistance to skidding, regardless of the way in which the plate is laid or the angle from which it is approached. The risers of the floor plate are so designed that there are no long surfaces on which to slide, and the spacing is such that the foot is always in contact with several risers extending at right angles to one another. Thus, there is resistance to sliding or skidding whether the plate is wet or dry. The risers are flat on top, so they feel comfortable under foot.

The pattern of the floor plate is continuous, whether adjoining plates are laid end to end, side to side, or end to side. This symmetrical design minimizes waste in cutting the plates. There are no pockets in which dirt or water can accumulate, and so this floor plate can be readily kept clean.

Multigrip floor plate is rolled from open-hearth steel in six thicknesses, from 3/16 to 1/2 inch, inclusive. The weight per square foot ranges from 8 3/4 to 21 1/2 pounds. Lengths from 10 to 40 feet are available. The widths range from 6 inches to 7 feet.

Machine Tool Meeting in Chicago

The Chicago section of the American Society of Mechanical Engineers held its annual machine shop practice meeting on the afternoon and evening of March 28 in the auditorium of the Engineering Building in Chicago. Five papers were presented, as follows: "High-speed Machining for High-speed Transportation," by P. S. Jackson, assistant manager, Rockford Machine Tool Co., Rockford, Ill.; "High-speed Tapping," by H. Goldberg, vice-president, R. G. Haskins & Co., Chicago, Ill.; "The Romance of Perfect Lubrication," by H. A. S. Howarth, vice-president and general manager, Kingsbury

Machine Works, Inc., Philadelphia, Pa.; "Probable Trends in the Machinery Industry," by R. E. W. Harrison, Chief of the Machinery Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.; and "Development of High-speed Production Machine Tools Recently Installed in Detroit," by R. A. Schafer, chief designing engineer, National Automatic Tool Co., Richmond, Ind.

A feature of the meeting was a demonstration of some of the machine tools discussed in the technical papers—this feature adding considerable interest to the gathering.

File-Testing Machine

Patents have recently been granted to F. Herbert Smith, of Cranston, R. I., for a file-testing machine, the purpose of which is to ascertain the actual value of files when in use. The machine tests files of all lengths from 4 to 18 inches, and the test applies to the entire length of both sides of the file. It not only tests flat files, but is adapted also for testing round, half-round, square, and triangular shapes. The results of the testing operation for each file are shown on the face of a scale which indicates the relative efficiency of the files tested, and thereby permits a direct comparison to be made.

Overcoming Machinery Vibration

During recent years several new methods have been developed for dampening vibration in machinery. One of these means is the cork isolation mat. The cork mat is generally used underneath concrete foundations. It is rarely used directly in connection with machines, except very large equipment. It is, however, of considerable importance to isolate, as far as possible, the vibrations of a machine, as it is likely that vibrations from one machine may affect the operation of other machines.

The Korfund Co., Long Island City, N. Y., quotes an interesting example. A concern manufacturing Diesel engines had a large grinder that was placed near the power house where a number of Diesel engines operated. These engines created a vibration that was transmitted to the grinder. The entire concrete block on which the grinder was mounted was isolated by means of cork plates, and the vibration was thereby practically eliminated.

Machinery vibrations can also be isolated by spring suspension. The company mentioned has developed a "Vibro-damper" which has found many applications in the machine shop field, especially in connection with punch presses and other types of heavy equipment. An interesting experience in this connection may be quoted: About seven years ago, an automobile manufacturer found difficulty in operating punch presses on an upper floor, in spite of the fact that the floor was from 12 to 15 inches thick. By installing Vibro-dampers and thereby providing for vibration isolation by spring suspension, the impact on the floor was cut down to such an extent that no further difficulties were experienced. Since that time the firm has mounted twenty-five machines on Vibro-dampers.

Vibration causes a great deal of trouble to both operating and designing engineers. The correct application of vibration isolation will solve these difficulties in most cases. It is usually of importance, however, to have the problem solved by an engineer experienced in isolating practice, since the whole matter of vibration is frequently of a very complicated character. It is not advisable to jump at conclusions. Past experience is a valuable guide in the solving of problems of this type.

The Social Security Legislation

A booklet entitled "Social Security—The Great Delusion," has been prepared by N. W. Pickering, president of the Farrel-Birmingham Co., Inc., and Allen W. Rucker, and is published by the Farrel-Birmingham Co., Inc., Ansonia, Conn. According to the arguments presented in this carefully prepared analysis, the payroll tax incorporated in the Wagner-Lewis Social Security Bill would reduce purchasing power, raise prices, and thereby increase unemployment. The authors oppose the proposed legislation and advocate a return to methods that will accomplish the results wanted in a practicable manner.

Since there is no inexhaustible fund from which manufacturers can pay new taxes, especially in view of the fact that under present conditions many manufacturing establishments are conducted not only without profit, but at actual loss, it is evident that industry in general can do only one of two things about the proposed payroll tax—(1) pay it and reduce wages by the amount of the tax; or (2) make no reduction in wages but increase prices, thus reducing the demand for the manufactured product, and in due time, reducing employment. The latter course is the one that industry would probably have to adopt in most instances.

The authors offer as a practicable basis of social security the following program: (1) Relieve manufacturers of the obligation of fixed wage rates in order that they may adjust production costs and prices to the point where maximum demand is stimulated; (2) permit flexible working hours in order that each industry may develop its maximum efficiency and produce to sell at the lowest price; (3) encourage industry to increase the productivity of its workers (and thereby their annual wage) by investing capital in improved processes and equipment; (4) encourage investors to supply capital to industry by removing artificial barriers and inspiring confidence in the possibility of reasonable returns on the investment.

"Herein," say the authors, "lies the true basis for social security; a condition which makes it possible for the greatest number of people to freely produce, exchange, and consume the maximum quantity of industrial and agricultural products." This is worth careful thought.

Getting Results through Cooperation

Not only does every human activity involving more than one individual require the function of management, but the success of the activity is affected by the character of the management. The success of the sewing circle is affected by its chairman; the success of the Lodge, by its Master; the success of the state, by its governor; the success of a company, by its foremen, superintendents, and officers; and the success of the United States, by its president.

Presently we are striving to effect recovery and re-employment. Recovery depends upon the soundness of plans and economic policies, upon the character of the management executing the plans and policies, and, equally important, upon the cooperation of all concerned with the management. Cooperation with management means following the leader. It means giving assistance to the work to be done. It means "teamwork." Conversely, it means to refrain from hindering in any way.—George P. Torrence, President, Link-Belt Co., in *Link-Belt News*

* * *

Tool Institute Elects Officers

At the annual convention of the Special Tool, Die & Machine Shop Institute held in Cleveland, the following officers were elected: President, F. S. Blackall, Jr., president-treasurer of the Taft-Peirce Mfg. Co., Woonsocket, R. I.; vice-president, H. A. Stoddard, Interstate Mechanical Laboratories, New York City; treasurer, G. A. Barth, Barth Stamping & Mfg. Co., Cleveland, Ohio; and secretary, George J. Huebner, Special Tool, Die & Machine Shop Institute, 1225 Guarantee Title Building, Cleveland, Ohio. There are now over 3500 shops in the special tool, die and machine shop industry throughout the country.

* * *

No greater mistake could be made than for anyone to suppose that prosperity can be achieved by paying a man \$5 a day for holding a shovel somewhere along a highway.—William B. Stout, President-elect of the Society of Automotive Engineers

... COMPACT
... SELF-CONTAINED
A HANDY "ALL-AROUND" UNIT

BROWN & SHARPE

No. 13 UNIVERSAL and TOOL GRINDING MACHINE —MOTOR DRIVEN

—for rapid and convenient handling of work on centers as well as tool and cutter grinding of wide variety.

—Note compactness, with main driving motor in base and individual motor for headstock drive.

—In addition to the Universal Head furnished, the range of the machine can be broadened by the following attachments available:

...Wet Grinding — Surface Grinding—Radial Grinding
 —Hob Grinding—Internal Grinding—Index Centers—
 Angular Wheel Truing — and Circular Forming Tool Grinding Equipment.

May we send details?

Brown & Sharpe Mfg. Co.
 Providence, R. I., U. S. A.

Capacity: Centers Swing 8" dia.; take 24" length
 Longitudinal table feed; 18", automatic



BS

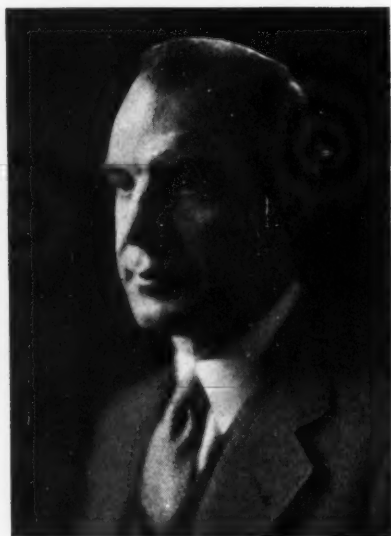
NEWS OF THE INDUSTRY

Connecticut

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., at a recent meeting of the board of directors, re-elected the following officers: Chairman of the board, Franklin Farrel, Jr.; president, Nelson W. Pickering; vice-presidents, Carl Hitchcock, Franklin R. Hoadley, and Armin G. Kessler; treasurer, Frederick M. Drew, Jr.; and secretary, George C. Bryant.

J. C. KAIMER has joined the Apex Tool & Cutter Co., Inc., Shelton, Conn., as engineer and district sales manager, and will service the company's line of inserted tools in the New York, New Jersey, and Pennsylvania territory. For twelve years previously, he was engineer and representative for the O. K. Tool Co., of Shelton.

PRATT & WHITNEY CO., Hartford, Conn., announces several changes in personnel: HUBERT D. TANNER has been appointed manager of the machinery division, and EDWARD J. O'MALLEY superintendent of all manufacturing divisions in both the machinery and Keller divisions. ALDEN M. DRAKE, formerly chief engineer, now assumes charge of a new department being formed for the development of improved machines, tools, and appliances for the production of Pratt & Whitney small tools. CARROL KNOWLES, formerly a designing engineer for the company, has been appointed chief engineer in full charge of the machinery engineering department. R. F. V. STANTON is now research engineer of the en-



Hubert D. Tanner, Manager of the Machinery Division of the Pratt & Whitney Co.

gineering division. EUGENE SULLIVAN has been made general foreman of all manufacturing in building No. 4 of the machinery division. B. G. DENLINGER has been appointed general foreman of the Keller division.

Georgia

ANTHONY S. TEIBERIS has been appointed general manager of the Columbus Truck & Supply Mfg. Co., Columbus, Ga., manufacturer of textile trucks, textile dyeing machinery, and equipment. Mr. Teiberis was previously vice-president and general superintendent with the Master Tool Co. of Cleveland, Ohio.

Illinois

NATIONAL COPPER PAINT CO., 666 Lake Shore Drive, Chicago, Ill., has been organized to manufacture and market a newly evolved liquid copper paint which contains 98.3 per cent copper. H. M. Rice, manager of the Nichols Copper Co., Chicago, Ill., will be president of the new company. A plant containing approximately 50,000 square feet of manufacturing space has been established in Chicago, with L. D. PANGBORN, one of the originators of the liquid copper paint, as plant manager.

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill., has appointed the GENERAL SUPPLY CO., S. A. Calle Balderas No. 56-58, Mexico, D. F., stock-carrying distributor of Link-Belt conveying and power-transmitting machinery in the Federal District and the state of Mexico.

NORMAN L. PEARSON, assistant equipment sales manager of All-Steel-Equip Co., Inc., Aurora, Ill., manufacturer of steel shop and office equipment and electrical wiring specialties, has been appointed sales manager of the industrial division.

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill., are planning to exhibit some of the newer steels and alloys at the Inform-a-Show of the National Purchasing Agents Association to be held at the Waldorf-Astoria Hotel in New York City, May 20 to 23.

Michigan and Wisconsin

L. K. LINDAHL was elected vice-president and general manager of the Udy-lite Co., Detroit, Mich., at the last



L. K. Lindahl, New General Manager of the Udylite Co.

annual meeting of the board of directors. Mr. Lindahl has been associated with the company for twelve years. He was appointed sales manager in 1929, which position he held to the time of his present promotion.

EDWARD S. ERICKSON, formerly vice-president in charge of production and research with the Mullins Mfg. Co., Salem, Ohio, has become associated with the Young Radiator Co., Racine, Wis.

New York

MCCALLUM-HATCH BRONZE CO., INC., Buffalo, N. Y., has acquired the business of WILLIAM H. BARR, INC., also of Buffalo, manufacturer of brass, bronze, copper, and aluminum castings. The new company will include the same personnel as the old company, and will continue the same line of manufacture, specializing in castings subject to rigid specifications and tests. The general offices will be continued at 27 Carolina St. and the foundry at 242 Fourth St., Buffalo. The officers of the new company will be John C. McCallum, president and treasurer; James A. Hatch, vice-president and sales manager; and William F. Hagedorn, secretary.

OAKITE PRODUCTS, INC., 26 Thames St., New York City, will have an unusual display at the exhibit of the American Electro-Platers' Society in Bridgeport, June 10 to 14. The display will consist of sample units of a wide variety of plated work. A working demonstration will also be given of Oakite Saturol, a process originated by the Oakite organization for cleaning cold-rolled steels and other metals.

GEORGE H. BUCHER has been elected a vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. He

An Effective Aid in Combatting

"DOWN" TIME

...Due to Frequent Tool Resharpenering

EQUIPMENT idle... production time lost... while tools that dull too rapidly are being changed!

That's a condition every shop executive is seeking to avoid, because operating delays are *costly*.

To help prolong intervals between tool regrinds, we suggest the effectiveness of Sunoco Emulsifying Cutting Oil. Its long service record shows *outstanding* performance. Results are seen in longer runs per tool grind, less lost time for resetting—and reduced tool maintenance costs.

Machine Tool Efficiency is Higher with SUNOCO

With Sunoco, machine tools achieve smooth and chatterless operation, greater accuracy, greater output and fewer rejects. Not without good reasons has this cutting oil been adopted so widely in the industry!

Faster Grinding without Increased Wheel Wear

In grinding, Sunoco makes possible faster stock removal without increasing wheel wear and yet reduces to a minimum the danger of burning the work. Even at high surface speeds, abrasive wheels stay cool.

Sunoco can be used over and over again without oxidizing or developing obnoxious odors.

Operation: Machining wheel end of automobile axle shaft.

Machine: Monarch "Magnetic" Lathe.

Lubricant: 1 part Sunoco to 15 parts of water.

*Courtesy of
Monarch Machine Tool Co.
Sidney, Ohio*

SUNOCO

EMULSIFYING
CUTTING OIL

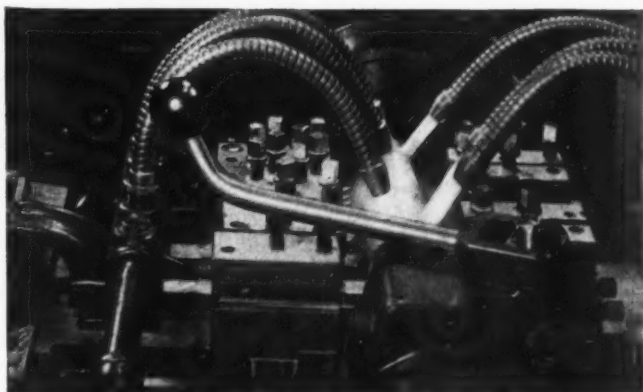
Operation: Grinding differential pinions.

Material: Chrome-nickel steel.

Machine: Bryant Hole Grinder.

Coolant: 1 part Sunoco to 40 parts of water.

*Courtesy of
Buck & Hickman, Ltd.
London, England*



SUN OIL COMPANY PHILADELPHIA, PA., U. S. A.
Offices and Warehouses in more than 100 Cities

*Subsidiary • Sun Oil Co., Ltd., Montreal, Toronto
Companies • British Sun Oil Co., Ltd., London, England*

will make his headquarters in New York City. Mr. Bucher, who is also president and general manager of the Westinghouse Electric International Co., has been connected with the Westinghouse organization since September, 1909.

WILLIAM T. SHALER, formerly with S. Howes Co., Silver Creek, N. Y., has joined the Ajax Flexible Coupling Co., Westfield, N. Y., as engineer in charge of the development of the Shaler Shaker, a device for imparting reciprocating motion to sieves for screening and separating grain, sand, or other granular products.

CLIFFORD E. BROOME, formerly engineer with Wm. Ganschow Co., Chicago, Ill., and more recently with Gears & Forgings, Inc., Cleveland, Ohio, has joined the organization of the Ajax Flexible Coupling Co., Westfield, N. Y., as engineer in charge of the Lectrigear division.

BYRON B. MORTON, formerly plant metallurgist at the Baton Rouge refinery of the Standard Oil Co. of Louisiana, has joined the metallurgical staff of the International Nickel Co., Inc., 67 Wall St., New York City.

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, has appointed the ATLAS SUPPLY CO., INC., 35 39 Woodward Ave., Brooklyn, N. Y., warehouse distributor of rust-resisting Toncan iron sheets.

Ohio

GEORGE D. MILLER CO., 2168 W. 100th St., Cleveland, Ohio, has been appointed exclusive representative in the Cleveland territory for the W. F. & John Barnes Co., Rockford, Ill., manufacturer of multiple-spindle, hydraulic-feed drilling machines, tapping machines, boring machines, way-type drilling, tapping, and boring machines, special milling machines, special hydraulic feed lathes, and self-contained square-ram hydraulic drill units.

C. T. GREENIDGE has joined the technical staff of the Battelle Memorial Institute of scientific and industrial research, Columbus, Ohio. Mr. Greenidge was previously a research metallurgist with the A. O. Smith Corporation in Milwaukee. He has been assigned to work in connection with a new industrial project in the metallurgy of steel established at the Institute.

CARLOS M. HEATH has been appointed assistant metallurgist on the staff of the Battelle Memorial Institute of industrial and scientific research, Columbus, Ohio. Prior to joining the Battelle staff, Mr. Heath held a position in the metallurgical department of the American Brass Co. at Waterbury, Conn. He has been assigned work connected with a new metallurgical project in the non-ferrous field.

RAY P. TARBELL was recently appointed manager of the welding division of the Ideal Electric & Mfg. Co., Mansfield, Ohio. Mr. Tarbell was previously with the Lincoln Electric Co. for thirteen years.

Pennsylvania and New Jersey

ERLE G. HILL has joined the Lukens Steel Co., Coatesville, Pa., as director of research. Mr. Hill was an associate professor of metallurgy at the University of Pittsburgh for ten years, during which time he also served as consultant for various companies in mining and metallurgical fields. He severed that connection to accept a research fellowship at the Mellon Institute of Industrial Research, remaining in that work until his present appointment.



*Erle G. Hill, Director
of Research of the
Lukens Steel Co.*

UNITED ENGINEERING & FOUNDRY CO., Pittsburgh, Pa., announces that the Amtorg Trading Corporation has placed with the company an order for the Zaporozstal Steel Works for a complete Timken-bearing equipped, electrically driven, steel rolling mill. The order, valued at more than \$3,000,000, is one of the largest of its kind ever placed in the United States for foreign shipment.

W. A. HAUCK has been appointed assistant to the president of the Lukens Steel Co., Coatesville, Pa. Prior to joining the Lukens organization, Mr. Hauck was connected with the American Iron and Steel Institute, and was engaged in work in connection with the Code of the iron and steel industry.

J. B. RITTENHOUSE, vice-president of the Synthane Corporation, has transferred his headquarters from Chicago to the main office at Oaks, Pa.

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., 34 Townsend St., Passaic, N. J., announces that patents have been granted to the company on the construction of a low-tension rubber belt known as the "Condor Compensated" belt. Because of the construction of this belt, ply stresses are equalized when the belt bends around the pulley.

NEW BOOKS

APPLIED WORKING DEFLECTION PRINCIPLES OF HELICAL SPRING DESIGN. Compiled by Walter H. Roe. 8 pages, 8 1/2 by 11 inches. Published by Walter H. Roe, 82 Liberty St., Tiffin, Ohio. Price, \$1.

This booklet, containing seven pages of formulas, charts, and tabular matter pertaining to helical spring design, in addition to a page of explanatory text, is reproduced directly from the original manuscript, charts, and tables, and gives spring formulas conveniently arranged for calculations, together with tables giving certain factors used in the formulas.

ELECTRICAL YEAR BOOK (1935). 311 pages. 4 by 6 1/4 inches. Published by Emmott & Co., Ltd., 31 King St. West, Manchester, England. Price, 1/6.

This is the twenty-eighth edition of a little handbook for electrical engineers. In this edition a new section on rectifiers has been included. The general electrical engineering data has been extensively revised and brought up to date.

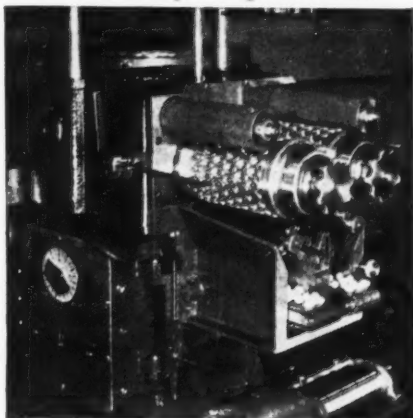
PROPERTIES OF GRAY CAST IRON AS AFFECTED BY CASTING CONDITIONS. BY C. M. Saeger, Jr., and E. J. Ash. 5 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Research Paper RP726 of the National Bureau of Standards. Price, 5 cents.

THE CREEP AND FRACTURE OF LEAD AND LEAD ALLOYS. By Herbert F. Moore, Bernard B. Betty, and Curtis W. Dollins. 50 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 272 of the Engineering Experiment Station. Price, 50 cents.

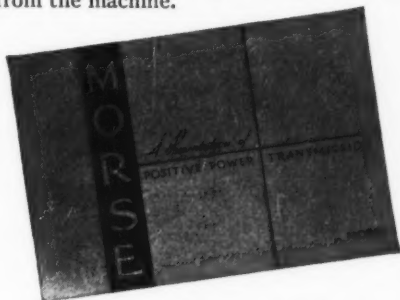
VOCATIONAL EDUCATION AND CHANGING CONDITIONS. 112 pages, 5 3/4 by 9 inches. Published by the United States Department of the Interior, Washington, D. C., as Vocational Education Bulletin No. 174. Price, 15 cents.

POWER TRANSMISSION NEWS

A large Metropolitan police department after exhaustive tests selected Morse Roller chains as standard motorcycle chains. Their experience shows that Morse Roller Chains stand up better and longer than any other... a tribute to their quality and stamina. These chains are subject to all kinds of severe operating conditions.



An interesting application of Morse 3/16" pitch chain is illustrated in the above picture. This machine makes and fills gelatine capsules, the 3/16" chain is used as a carrier for the capsules as they come from the machine.



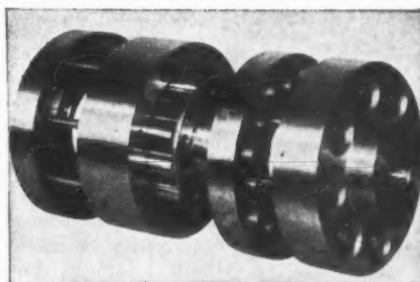
Morse has recently produced a large sized portfolio illustrating many applications of chain drives. This book is available to power transmission users. Ask the Morse Chain Company, Ithaca, New York for a copy of this new book.



Morse roller chains are finding many varied uses in industry. Here they are driving a mixing tank in the laboratory of a large enamel and lacquer manufacturing factory. Improved design, better materials and ample provision for lubrication mean longer and more satisfactory service.

The Morse Improved Kelpo free-wheeling clutch is now offered in three different types... Morflex... Ratchet... and Back Stop. This new Morse designed clutch embodies the use of solid accurately ground alloy steel cams. Each cam is independently sprung for rapid and accurate engagement. Driving pinion on all models is ball bearing mounted, self lubricated with adequate leather and felt oil seals.

The Morse Improved Kelpo line comprises eight different sizes, rated in capacity from 1/8 h.p. at 100 r.p.m. to 12 h.p. at 100 r.p.m.



Photograph shows Cam Construction, Morflex type

Chain Drives

FOR modern precision machine tools, Morse Chains provide a uniform flow of power at constant speed from the driving motors to all moving parts, combining all the good characteristics of all forms of drives and assuring maximum production.

Chain drives are flexible, non-slipping, economical and adaptable to any transmission requirement.

ALWAYS USE CHAIN DRIVES

MORSE CHAIN COMPANY

DIVISION OF BORG-WARNER CORPORATION
ITHACA · NEW YORK

OBITUARIES

Dr. William H. Beardsley

Dr. William H. Beardsley, a director of the Jones & Lamson Machine Co., Springfield, Vt., passed away March 2 at the Mary Hitchcock Hospital in Hanover, N. H. His death was caused by a spinal infection, apparently of some months' standing, which had lain dor-



Dr. William H. Beardsley

mant until revived by a slight cold about two weeks before his death.

Dr. Beardsley was born in Bridgewater, Conn. in 1882. He graduated from the Yale Medical School in 1910, and after serving as interne and taking advanced training in various hospitals, he engaged in the practice of his profession in Springfield, Mass. He went to Springfield, Vt., in 1915, joining the Jones & Lamson Machine Co., where he was successively manager of the Fay automatic lathe department, production superintendent, and a director of the company.

Dr. Beardsley was also active, highly regarded, and widely influential in public affairs. He had served as president of the Springfield Community Council, and at the time of his death was president of the Springfield Hospital. He was a selectman of the town, and unopposed, was nominated for re-election. He served two terms as State Senator and a term as president of the State Chamber of Commerce, in which capacities he left a record of useful achievement.

Dr. Beardsley is survived by his widow, Anna Hartness Beardsley, his son, Hartness (now absent in Alaska on an exploring and mapping expedition for the National Geographic Society), and two daughters.

Dr. Beardsley was a man of fine personal characteristics. His sincerity and friendliness were apparent to all who knew him, and his many friends deeply regret his passing.

Fred C. Thompson

Fred Crawford Thompson, vice-president and general manager of the Morse Chain Co., a subsidiary of the Borg-Warner Corporation, Detroit, Mich., died at his home in Detroit on March 6, aged fifty-one years. Mr. Thompson had been identified with the automotive industry for thirty-two years and was recognized as one of its pioneers and leaders.

Born in Emlenton, Pa., in 1884, he started his career as a draftsman with the Westinghouse Electric & Mfg. Co. Later he was associated with the Pope-Toledo Co. as a designing engineer. He had also been connected with the Fairbanks-Morse Co. and the Buda Co., and in the early days of the automotive industry, was chief engineer of the Lozier Motor Co. In 1914, he joined the Morse Chain Co. as Detroit manager, and during the last five years was vice-president and general manager of the company. Many of his inventions are now being used by the automotive industry.

James F. Leahy

James F. Leahy, general superintendent of the Buffalo plant of the Farrel-Birmingham Co., Inc., died at his home in Kenmore, N. Y., on March 6, after a month's illness. Mr. Leahy was born in Torrington, Conn., on October 23, 1870. He lived in Ansonia for twenty-two years, where he had been in the employ of the Farrel organization since 1901. He had served as machine shop foreman of the Ansonia plant before being transferred to the superintendency at Buffalo. In 1922, he and the late David R. Bowen accompanied Franklin Farrel, Jr., to England to investigate the gear-cutting process invented by W. E. Sykes. Upon their recommendation, the Farrel company purchased the American rights to this process.

DAVID F. NOBLE, Chicago representative of the Foote-Burt Co., Cleveland, Ohio, died February 15 at his home in Winnetka, Ill., following a heart attack. Mr. Noble was born in 1883 at New Boston, Ill. A graduate of Knox College, class of 1902, he went to Chicago and entered the machine tool business with the Essley Machinery Co.; later he became affiliated with the Marshall-Huschart Machinery Co. In 1926, he started his own business as a dealer, handling equipment adapted for the automotive industry.

RALPH H. CLORE, general sales manager of the Medart Co., St. Louis, Mo., died on March 6.

COMING EVENTS

MAY 10-31—INTERNATIONAL METAL INDUSTRIES EXHIBITION to be held at the Commercial Museum in Osaka, Japan. For further information address Agne, Okamoto nr. Kobe, Japan.

MAY 14-15—Annual meeting of the AMERICAN GEAR MANUFACTURERS' ASSOCIATION at the Penn-Lincoln Hotel, Wilkinsburg, Pa. J. C. McQuiston, manager-secretary, Penn-Lincoln Hotel, Wilkinsburg, Pa.

JUNE 16-20—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 19-21—Summer meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS to be held in Cincinnati, Ohio. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

JUNE 24-28—Thirty-eighth annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Book-Cadillac Hotel, Detroit, Mich., in conjunction with an exhibit of testing apparatus and related equipment. Secretary's address, 260 S. Broad St., Philadelphia, Pa.

JUNE 25-27—GREAT LAKES POWER SHOW on the Steamer *Seandbee*, exhibiting at Buffalo, June 25; at Cleveland, June 26; and at Detroit, June 27. Ernest H. Smith, manager, 3910 Carnegie Ave., Cleveland, Ohio.

JULY 15-20—INTERNATIONAL CONGRESS FOR SCIENTIFIC MANAGEMENT in London, England. For further information, address Industrial Development Association, British Empire Bldg., 620 Fifth Ave., New York City.

AUGUST 19-23—Convention of the AMERICAN FOUNDRYMEN'S ASSOCIATION at Toronto, Canada, with headquarters at Hotel Royal York. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

SEPTEMBER 11-21—MACHINE TOOL EXPOSITION to be held in Cleveland, Ohio, under the auspices of the National Machine Tool Builders' Association, 1220 Guarantee Title Bldg., Cleveland, Ohio.

SEPTEMBER 30-OCTOBER 4—NATIONAL METAL EXPOSITION AND CONGRESS under the auspices of the American Society for Metals to be held in the International Amphitheatre, 43rd and Halsted Sts., Chicago, Ill. W. H. Eisenman, secretary, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

Multiple Tool Set-ups

Mean Multiple Savings

with

CARBOLOY



The increased tool life of Carboloy, due to its extreme hardness and unusual resistance to abrasion, results in substantial savings on *all* jobs. These savings are, however, particularly important on multiple tool set-ups because you obtain a large reduction in costly set-up and grinding time.

As an indication of the savings you can make, a recent analysis of Carboloy tool life compared to high speed steel tool life will be of interest. Based on the performance of 100 jobs representing a wide variety of conditions, the following ratio was obtained: Cast Iron—29:1, Aluminum Alloys—32:1, Brass, Bronze,

Copper—36:1, non-metallic materials 30:1.

Check the savings in set-up time *alone* that you can make with this increased tool life on *your* multiple tool jobs. Then add to these savings the additional economy of increased speeds, closer tolerances, less grinding time and better finish. It is because of these savings—savings not possible with ordinary tools, that many of the nation's foremost industrial concerns are using Carboloy tools extensively throughout their plants.

Get full information on the benefits of Carboloy on *your* applications, and don't fail to include your multiple tool machining jobs.

CARBOLOY COMPANY, INC.

2987 E. JEFFERSON AVE., DETROIT, MICHIGAN

CHICAGO

CLEVELAND

NEWARK

PHILADELPHIA

PITTSBURGH

In Canada: Canadian General Electric Co., Ltd., Toronto, Ontario

CARBOLOY

REG. U. S. PAT. OFF.

CEMENTED CARBIDES

Classified Contents of this Number

DESIGN, FIXTURE AND TOOL

- Grooving Bar for Cutting Snap-Ring Recess—
By Charles J. Rayman..... 499
- Drill Jig with Tapered Locating Bushing—
By Frank Serral..... 502

DESIGN, MACHINE

- Don't Follow Current Trends without Analysis... 471
- Trends in Automotive Bearings that Apply in
General Machine Design—By Herbert Chase... 485
- Push-Button Mechanism for Alternately Chang-
ing Position of Lever—By P. E. Veraa..... 503
- Cam and Eccentric Mechanisms for Crank and
Lever Movements—By Paul Grodzinski 504
- Mechanism for Smoothing Wrapper over Ends of
Tapered Package—By Frank H. Mayoh..... 504
- Overcoming Machinery Vibration520-F

DIEMAKING, DIE DESIGN, AND PRESS WORK

- Die-Casting Dies that Achieve the Impossible... 464
- Four Cutting and Three Forming Operations in
One Press Stroke—By C. W. Hinman..... 500

MANAGEMENT PROBLEMS

- How Automobile Prices are Reduced..... 478
- A Great Industry that is Constantly Forging
Ahead 488

MATERIALS, METALS, AND ALLOYS

- Nickel-Chromium Cast Iron for Cylinder Blocks—
By Robert Cass 478
- Castings Take the Place of Forgings in
Automotive Practice 482
- Rubber Contributes to Quiet Operation of
Automobiles 484

MEETINGS AND CONVENTIONS

- Machine Tool Meeting in Chicago520-E
- Tool Institute Elects Officers520-F

NATIONAL INDUSTRIAL RECOVERY

- How the Automotive Industry has Led the
Recovery 484
- The Social Security Legislation520-F
- Getting Results through Cooperation.....520-F

NEWS OF INDUSTRY

- Wanderer-Werke Celebrates Fiftieth Anniversary 502
- News of the Industry520-G

SHOP PRACTICE

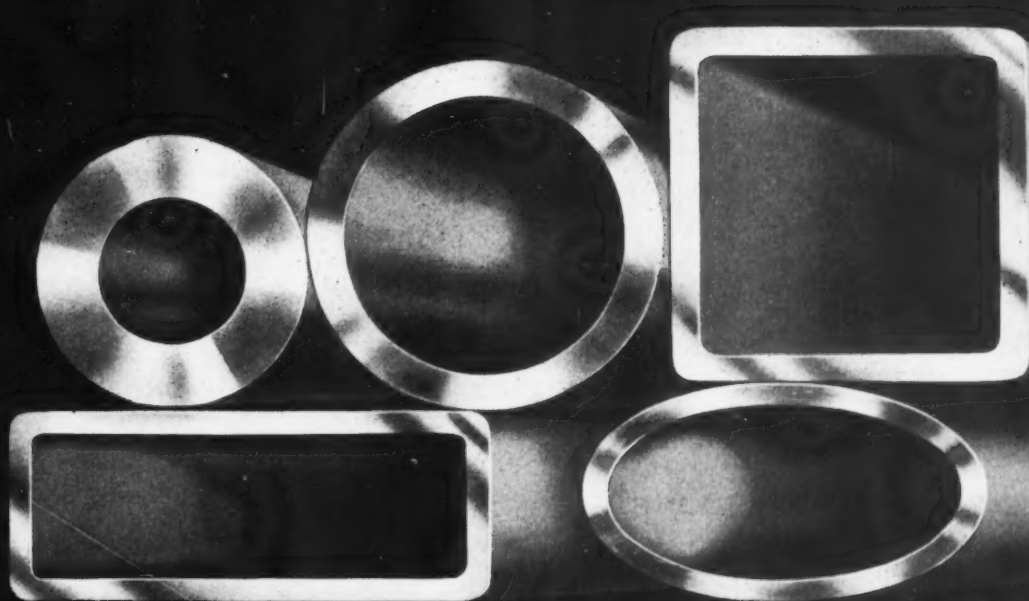
- Broaching at Buick—By Charles O. Herb 457
- Typical Grinding Operations in Automobile
Plants 462
- Diamond Turning and Boring of Automobile
Pistons—By C. A. Birkebak 468
- Engineering the Equipment for Automotive
Production—By H. E. Mills 472
- Grooving 2800 Piston-Rings an Hour..... 477
- Buses Assembled on Overhead Tracks 479
- Simplifying the Machining of a Complicated
Diesel Engine Part 483
- The Importance of Good Piston Fits 484
- New Equipment for Automotive Shops 489
- Shop Equipment News 509
- File-Testing Machine520-E

WELDING PRACTICE

- Welding Mufflers in 14 1/2 Seconds 498
- Recent Developments in Resistance Welding in
the Automobile Industry..... 498

Your Progress Depends Upon Your Knowledge of Your Industry

3 GOOD REASONS



- 1 MACHINING OPERATIONS ARE MINIMIZED**
- 2 LABOR IS ECONOMIZED**
- 3 WEAR ON TOOLS IS REDUCED**

Use NATIONAL-SHELBY Seamless Tubing for making modern-day parts and you will be up-to-the-minute in efficient manufacturing and cost-saving. Just a single cut or light grinding may be all that is needed to make your part, or perhaps simple swaging, expanding, or upsetting, either from hot-finished or cold-drawn tubing. The finished part will be of fine, uniform steel structure with exceptional strength and no excess weight. Available in practically any size and wall-thickness and in various shapes. Grades and treatments of steel are furnished to meet almost any use. Send for Seamless Handbook.

NATIONAL TUBE COMPANY • Pittsburgh, Pa.

Pacific Coast Distributors—COLUMBIA STEEL CO., San Francisco, Calif.
Export Distributors—UNITED STATES STEEL PRODUCTS CO., New York, N. Y.

United States Steel  *Corporation Subsidiary*

*Some things you
can do with
NATIONAL-
SHELBY
Seamless Tubing*

TWIST IT
WELD IT
THREAD IT
MACHINE IT
GRIND IT
SWAGE IT
COAT IT
BEND IT
COIL IT
UPSET IT
TEMPER IT
FLANGE IT
EXPAND IT
FLATTEN IT

SEAMLESS MECHANICAL TUBING

man & Nuetzel Machinery Co., St. Louis, Mo.; Barney Machinery Co., Pittsburgh, Pa.; Joseph C. Fletcher, San Francisco, Calif.; Galvin Machinery Sales, Buffalo, N. Y.; E. A. Kinsey Co., Cincinnati, Ohio; Marshall & Huschart Co., Indianapolis, Ind.; H. A. Smith Machinery Co., Syracuse, N. Y.; Williams & Wilson, Ltd., Montreal, Canada.

ROBERT MCGARRY, 807 Rose Place, Utica, N. Y., will represent the Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis., manufacturer of motor control equipment, in the Utica territory. BJORN HANSEN, 306 Canedy St., Springfield, Ill., will take charge of sales in the Springfield district. R. B. SODERBERG, 196 Palm St., Hartford, Conn., has joined the sales staff at Hartford, and W. J. HESS has taken over the sales work of the Charleston, W. Va., office at 912 First Ave. CLAUDE O. SARGENT has been appointed a member of the sales staff at the Philadelphia office. During the last five years Mr. Sargent has served as district sales manager of the Pittsburgh office of the Louis Allis Co.

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, has removed the New York district sales office to the Chrysler Building. The export department will also occupy part of the new quarters in the Chrysler Building. The company also announces the appointment of the Gilmore Steel & Supply Co., 825 Folsom St., San Francisco, Calif., as warehouse distributor for Enduro stainless steel.

RIEHLE BROS. TESTING MACHINE CO., Philadelphia, Pa., manufacturer of Riehle testing machines, has become a part of AMERICAN MACHINE & METALS, INC., East Moline, Ill. Abbott F. Riehle will continue as general manager, with headquarters at the new executive office, 100 Sixth Ave., New York City. The engineering staff and key men have been transferred from Philadelphia to East Moline.

CARBIDE & CARBON CHEMICALS CORPORATION, 205 E. 42nd St., New York City, announces that its new plant at Whiting, Ind., was recently placed in operation. In addition to the increased production from the Whiting Plant, the corporation's manufacturing facilities at South Charleston, W. Va., are being enlarged.

J. S. VANICK, of the development and research department of the International Nickel Co., Inc., 67 Wall St., New York City, recently addressed the Montreal Chapter of the American Society for Metals on the relative merits of casting against chills, cyaniding, nitriding, heat-treating, and alloying.

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J., has established an Eastern Oil Power Division, with headquarters at 2 Park Ave., New York City, to take care of the increased activity in its Diesel and gas engine lines. RAY L. HOWES is in charge of the new division.

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio, has moved the New York offices of both the crane and tram-rail divisions of the company from 50 Church St. to 60 E. 42nd St.

HARRY H. RABER has been appointed assistant to the general manager of the New York Belting & Packing Co. with headquarters at the company's main office and factory in Passaic, N. J.

Ohio

ED. J. BUTLER has joined the sales staff of the Bunting Brass & Bronze Co., Toledo, Ohio. Mr. Butler was previously



Ed. J. Butler, a New Member of the Sales Staff of the Bunting Brass & Bronze Co.

associated with the Toledo Steel Products Co. and the Moto Meter Gauge & Equipment Corporation.

BATTELLE MEMORIAL INSTITUTE, Columbus, Ohio, has appointed Dr. BRUCE A. ROGERS, MYRON R. NESTOR, and PHILIP C. ROSENTHAL members of the technical staff of the Institute. Dr. Rogers was previously connected with the Bureau of Standards, where he had charge of a survey of the engineering uses of silver. He was connected for several years with the metallurgical division of the Western Electric Co. in Chicago. At the Battelle laboratories he will be senior metallurgist, engaged on a new program of research work relating to the automotive industry.

M. A. BECKMANN, who has been with the Aluminum Industries, Inc., Cincinnati, Ohio, since its inception and has risen to the position of works manager, was elected a director at the annual meeting of stockholders in March, to fill the vacancy caused by the death of H. J. Beck, former vice-president and assistant treasurer.

ARTHUR H. WILLIAMS has been appointed factory manager and general superintendent of the Cleveland Automatic Machine Co., Cleveland, Ohio. Mr. Williams was formerly chief engineer and production manager of the Shafer Bearing Corporation, Chicago, Ill., and previous to that, was research engineer with the Chrysler Corporation, Detroit, Mich.

OLIVER F. REDD has joined the research department of the Patterson Foundry & Machine Co., East Liverpool, Ohio. Mr. Redd has been engaged for several years in development engineering work in the Bell Telephone Co.'s laboratories at Chicago.

HARRY W. MCQUAID, of the metallurgical staff of the Republic Steel Corporation, Youngstown, Ohio, recently spoke before the Duluth Engineers' Club, Duluth, Minn., on the subject "The Revolution in Steelmaking."

GEORGE H. RALLS has resigned as director of sales of the parts division of the Chrysler Corporation to become president of Pressure Castings, Inc., Cleveland, Ohio, manufacturer of die-castings.

Pennsylvania and Maryland

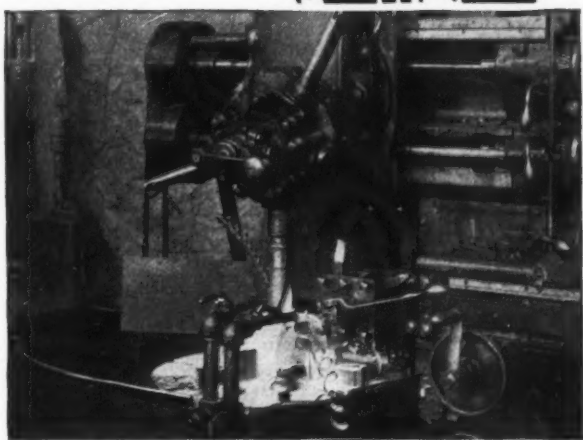
WALTER E. BARNES has been appointed assistant to the vice-president in charge of sales of the Lukens Steel Co., Coatesville, Pa. Mr. Barnes has been connected with the Lukens organization for twenty-five years.

CARL O. HEDNER, manager of hoisting equipment sales for the Yale & Towne Mfg. Co., Philadelphia, Pa., was elected chairman of the Electric Hoist Manufacturers' Association at the eighteenth annual meeting, held in Buffalo in March. Mr. Hedner succeeds FRANK F. SEAMAN,



Walter E. Barnes, Assistant to Vice-president in Charge of Sales, Lukens Steel Co.

DRILL MORE HOLES PER GRIND



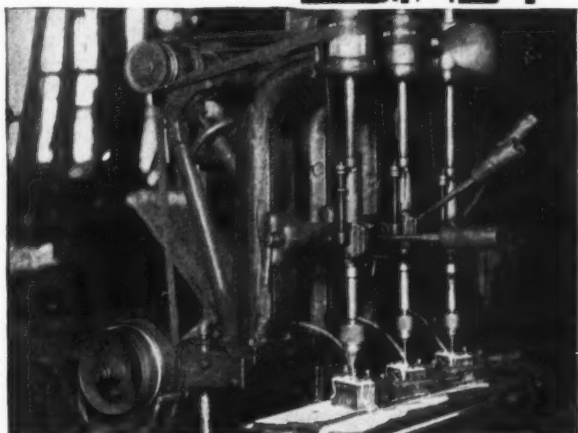
MACHINE: Bullard Vertical Turret Lathe.

MATERIAL: 3135 Steel.

DRILL: 2 1/4 in., 70 R.P.M.

LUBRICANT: 1 part Sunoco to 20 parts water.

*Courtesy of The Bullard Co.
Bridgeport, Conn.*



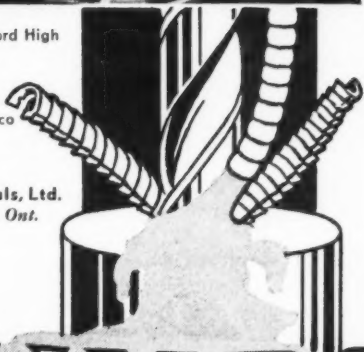
MACHINE: Leland - Gifford High Speed Drill Press.

MATERIAL: Bolt Steel.

DRILL: No. 3; 644 R.P.M.

LUBRICANT: 1 part Sunoco to 15 parts water.

*Courtesy of
Canadian Line Materials, Ltd.
Scarborough Junction, Ont.
Canada*



*with
Sunoco!*

THE drilling of metals is so often regarded as such a simple operation that it may be overlooked as an important factor in costs.

Actual performance records of Sunoco Emulsifying Cutting Oil prove that it definitely helps give greater production, greater accuracy and lower production costs in the drilling operations.

Drills Cut Faster

When Sunoco is the cutting oil utilized, you will find drills cut faster and produce more holes per grind.

The lubricating and cooling properties of this cutting oil aid drills in cutting true cylindrical holes of accurate size. Reaming and spoilage are reduced or eliminated.

No Clogging or Burning

Long drill life and low power costs go hand in hand with the use of Sunoco because drills clear easily, and do not clog, bind, chatter or burn.

You will find, by test, that Sunoco clearly qualifies for your drilling operations! Write now for details on Sunoco . . . and remember that the services of our experienced cutting oil engineers are at your disposal.

SUNOCO

EMULSIFYING
CUTTING OIL

**SUN OIL COMPANY
PHILADELPHIA**

Offices and Warehouses in More Than 100 Cities

*Subsidiary Companies: Sun Oil Co., Ltd., Montreal
British Sun Oil Co., Ltd., London, Eng.*

general manager of the hoist and crane division of Robbins & Myers, Inc., Springfield, Ohio. CHARLES A. MOORE, chairman of the board of Manning, Maxwell & Moore, was elected vice-chairman.

HARRIS-GREEN Co., Farmers Bank Bldg., Pittsburgh, Pa., has been formed by G. N. Harris and J. G. Green, formerly of the Westinghouse Electric & Mfg. Co., and Henry Harris, formerly president of the United Electric Light Co. of Wilmerding, Pa., for the purpose of selling motors, controls, transformers, power factor corrective devices, and similar equipment to industrial plants, utilities, and commercial establishments.

The Code Authority for the used machinery and equipment distributing trade has been approved by the National Recovery Administration. M. D. GALBREATH, of the Marr-Galbreath Machinery Co., Pittsburgh, Pa., is chairman of the Code Authority, and RALPH S. DAVIS, of Pittsburgh, executive secretary. The office of the Code Authority is at 307 Empire Bldg., Pittsburgh, Pa.

CHEVROLET MOTOR Co. has opened a new assembly plant at Baltimore, Md., where both passenger cars and trucks are now being produced.

Washington and Oregon

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, announces that the Seattle, Wash., district sales office of the company has been removed to the White-Henry-Stuart Building. C. D. WINTER continues in charge of the office as district sales manager, assisted by his present staff, to which has been added ARCHIE RIDER, recently transferred from the Youngstown office.

LINK-BELT Co., 910 S. Michigan Ave., Chicago, Ill., has recently moved its Portland, Ore., warehouse from Front Ave., where it had been located for approximately twenty years, to 14th Ave. and Savier St., where a complete line of conveying and power transmitting machinery will be carried. The company's sales office will also be located at the new address, 1637 NW. 14th Ave. D. L. Shirley is resident manager.

* * *

General Electric Pays \$2,600,000 in Pensions

Pension payments aggregating \$2,600,000 were paid to retired employees of the General Electric Co. during 1934. The General Electric Pension Trust created by the company now has assets of more than \$23,000,000. An additional pension plan, to which the employees also contribute, has on hand approximately \$6,000,000 to the credit of some 45,000 employees.

584-B—MACHINERY, May, 1935

NEW BOOKS AND PUBLICATIONS

MANUAL OF GEAR DESIGN—SECTIONS 1 AND 2. By Earle Buckingham, Professor of Mechanical Engineering, Massachusetts Institute of Technology. Approved by the American Gear Manufacturers' Association. Section 1, 183 pages; Section 2, 168 pages. Size of each book, 8 1/2 by 11 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price of either book, \$2.50; price of both books, \$4.50, cash with order; \$4.75 in three payments.

Section 1 consists entirely of mathematical tables especially applicable in gear design. The table of trigonometrical functions is extended to eight decimal places and gives functions to degrees and hundredths of a degree. There is also a conversion table for converting minutes into decimals of a degree.

The table of involute functions in Section 1 contains values that simplify the use of many practical gear-designing formulas found in Section 2. A table for converting degrees into radians gives the radian equivalents to eight decimal places. A table of gear ratios and their decimal equivalents contains 4468 ratios. The final table in Section 1 gives the factors of all numbers up to 6000.

All matter in both Sections 1 and 2 has been reproduced by the photo-offset process direct from the original tracings, thus insuring accurate reproduction of the numerous formulas and tables.

Section 2 of the "Manual of Gear Design" contains formulas, tables, designing data, and general information applicable to spur gears and internal gears. The book begins with a list of all gear terms used throughout the book. These terms are accompanied by their mathematical symbols and terse definitions with simple drawings and diagrams to illustrate each definition.

Formulas for the solution of right-angle and oblique-angle triangles are followed by a section on involute trigonometry. This section contains the formulas for determining values relating to tooth proportions, under-cut, duration of contact, etc. All problems are accompanied by examples showing just how each formula is applied.

Section 2 covers various tooth systems, such as, for example, the 14 1/2-degree composite, the 14 1/2-degree full depth, the 20-degree full depth, and the 20-degree stub. In each case, formulas for tooth proportions are given and also voluminous tables required either in connection with gear design or gear cutting. One series of tables gives the corrected tooth depths for formed milled gears. Thus, by adjusting

the depth of cut as shown by the table, a tooth profile of greater accuracy is secured without using an intermediate form cutter. The book contains very complete tables giving the contact ratios for various tooth systems and gear and pinion combinations.

In addition to the formulas and tables relating to specific tooth systems, there are sections on internal gear drives, differential gears, planetary gears, internal gear type clutches, backlash, gear tooth loads, non-metallic gears, and clock and instrument gears.

These are not text-books dealing with elementary principles, the author having presupposed that the user has some knowledge of this general subject. Eventually, Sections 1 and 2 will be followed by others, but some time may elapse before these are ready. Incidentally, Sections 1 and 2 will first be shown at the annual convention of the American Gear Manufacturers' Association, May 14 and 15, and these books will be ready for distribution on and after that date. They represent a vast amount of original work by Professor Buckingham, and it is believed that the complete formulas, with all of their applications demonstrated by examples, together with numerous time-saving tables, will be appreciated generally by machine and gear designers.

THIRTY YEARS OF EDUCATIONAL PIONEERING—THE PHILOSOPHY OF THE CO-OPERATIVE SYSTEM AND ITS PRACTICAL TEST. By Herman Schneider. 28 pages, 7 1/2 by 10 inches. Published by the University of Cincinnati, Cincinnati, Ohio.

This pamphlet is part of a program in celebration of the thirtieth anniversary (which will occur in 1936) of the establishment of the cooperative system in the College of Engineering and Commerce of the University of Cincinnati. Dean Schneider, the writer of this report, was the creator of the cooperative system of education and has been the administrator of this system in the University of Cincinnati for the last thirty years. The booklet outlines the origin of the cooperative system of education and describes how this system is being applied in the College of Engineering and Commerce, the Institute of Scientific Research, the Basic Science Research Laboratory, and the School of Applied Arts of the University.

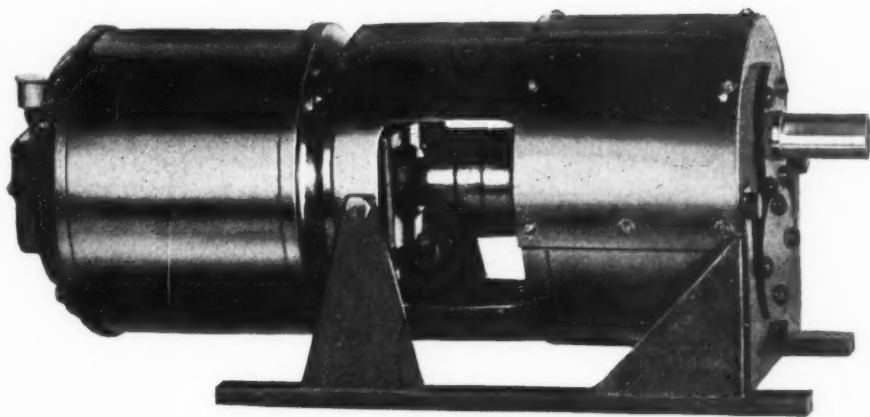
ELECTRIC ARC WELDING MANUAL. By W. J. Chaffee. 94 pages, 5 1/2 by 8 1/4 inches. Distributed by Hobart Bros. Co., Troy, Ohio. Price, \$1.

This is the second edition of an arc welding operator's manual. The pres-

LECTRIGEAR

**A
NEW
WAY**

**OF BUYING
SELLING
EQUIPPING
WITH
SPEED
REDUCERS**



Lectrigear Units are modern speed reducers for use with $\frac{1}{8}$ to 2 H.P. motors. The motor is bolted directly to the gear unit—the torque is carried in the proper place.

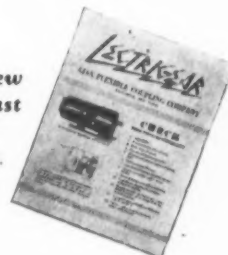
Lectrigear is a high class motorized speed reducer in material, workmanship and performance. By employing a simplified design, steel base and many other exclusive features Lectrigears solve the reducer problems of many manufacturers.

For the manufacturer who needs a speed reducer—a complete Lectrigear Assembly—a modern gear reducing unit with a built in motor.

For the machine manufacturer—Lectrigear Speed Reducer Units fitted to his machines and ready to receive the motor he selects.

For the motor manufacturer—with a ready market for correctly designed complete speed reducer assemblies—Lectrigear Units ready to be equipped with his motors.

There's a new
bulletin—just
ready—
send for it.



AJAX FLEXIBLE COUPLING COMPANY

12 ENGLISH ST., WESTFIELD, NEW YORK

MACHINERY, May, 1935—65

ent edition has been completely revised in order to include the many new developments in arc welding methods and applications, as well as in arc welding equipment. An effort has been made to present the facts in a non-technical manner, so that the book will be useful to the beginner as well as to the experienced operator. A new feature is a complete series of training exercises for operators. The material is divided into nine chapters covering the following subjects: The Welding Arc; Welding Equipment; Weldability of Metals; Types of Joints and Welds; Strength of Welds; Speed and Cost of Welding; Using the Metallic Arc; Welding with Bare Electrodes; and Welding with Coated Electrodes

OBITUARIES

Frank D. Dorman

Frank D. Dorman, since 1925 treasurer and general manager of the Automatic Machine Co., Bridgeport, Conn., died April 8 in his apartment at the Stratfield Hotel in Bridgeport at the age of seventy-six years. Mr. Dorman was born in Cleveland, Ohio. His entire business life was spent in the mechanical field. In the early days of the automobile industry, he was the dominating spirit in the American Motor Carriage Co. of Cleveland, Ohio. From 1905 to 1912, he was vice-president and general manager of the Maxwell-Briscoe Motor Co. of Tarrytown, N. Y., and was an associate of W. C. Durant in the formation of the original Chevrolet Motor Co. He was vice-president of the United States Motor Co. for a number of years prior to going with the Automatic Machine Co. in Bridgeport.

Mr. Dorman is survived by two brothers, a son, and two grandsons.

John Hill Whiting

John Hill Whiting, chairman of the board of the Whiting Corporation, Harvey, Ill., died on April 6. Mr. Whiting was born at Sault Ste. Marie, Mich., on October 11, 1850. Starting as a clerk in the foundry of the Michigan Car Co., Detroit, he rose rapidly to successive positions of responsibility until he became general superintendent of the plant. Mr. Whiting acquired several patents on equipment used in the manufacture of cupola furnaces and other equipment for foundries. He established a business of his own in 1884 for the manufacture of this equipment under the name of the Whiting Foundry Equipment Co., which has since become the

Whiting Corporation. The company's line was later expanded to include a wide range of products.

Robert C. Lind

Robert C. Lind, pioneer Rockford manufacturer and president of the Rockford Machine Tool Co., died April 13 in Rockford at the age of seventy-nine years. Mr. Lind was born in Sweden in 1856 and went to Rockford with his parents in 1871. Starting at the age of sixteen as a factory worker, he became not only an expert machinist, but also a skilled cabinet-maker. He early became prominently identified with the furniture industry in Rockford, and was, at his death, secretary of the Rockford Chair & Furniture Co. In 1905, he founded the Rockford Machine Tool Co. and served as its president until his death.

Frank L. Morse

Frank L. Morse, president of the Morse Chain Co., died at Orlando, Fla., March 25, at the age of seventy years. Mr. Morse, with his brother, founded the Morse Chain Co. of Ithaca, N. Y., and Detroit, Mich., and up to four years ago was active in its development and progress. He was also a director of the Borg-Warner Corporation, of the First National Bank of Ithaca, and of the Ithaca Trust Co., as well as president of the First National Bank of Orlando, Fla.

B. A. Snow, who first entered the employ of the Brown & Sharpe Mfg. Co., Providence, R. I., in 1902, and who for the last eleven years has represented that company in Pittsburgh, Pa., died at his home on April 17 from pneumonia.

JUNE 16-20—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 19-21—Summer meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS to be held in Cincinnati, Ohio. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

JUNE 24-28—Thirty-eighth annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Book-Cadillac Hotel, Detroit, Mich., in conjunction with an exhibit of testing apparatus and related equipment. Secretary's address, 260 S. Broad St., Philadelphia, Pa.

JUNE 25-27—GREAT LAKES POWER SHOW on the Steamer *Secandbee*, exhibiting at Buffalo, June 25; at Cleveland, June 26; and at Detroit, June 27. Ernest H. Smith, manager, 3910 Carnegie Ave., Cleveland, Ohio.

JULY 15-20—INTERNATIONAL CONGRESS FOR SCIENTIFIC MANAGEMENT in London, England. For further information, address Industrial Development Association, British Empire Bldg., 620 Fifth Ave., New York City.

SEPTEMBER 11-21—MACHINE TOOL EXPOSITION to be held in Cleveland, Ohio, under the auspices of the National Machine Tool Builders' Association, 1220 Guarantee Title Bldg., Cleveland, Ohio.

SEPTEMBER 30-OCTOBER 4—NATIONAL METAL EXPOSITION AND CONGRESS under the auspices of the American Society for Metals to be held in the International Amphitheatre, 43rd and Halsted Sts., Chicago, Ill. W. H. Eisenman, secretary, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

* * *

Publisher's Statement of Circulation of MACHINERY

This is to certify that the average circulation per issue of MACHINERY, for the six months' period July 1 to and including December 31, 1934, was as follows:

| | |
|--|---------------|
| Copies sold | 8,672 |
| Copies distributed free to prominent executives in the mechanical industry.. | 4,625 |
| Copies distributed free—miscellaneous | 820 |
| TOTAL | 14,117 |

THE INDUSTRIAL PRESS
EDGAR A. BECKER
(Treasurer)

Subscribed to and sworn before me on this 6th day of March, 1935.
(Notary's Seal)

CHARLES P. ABEL
Notary Public, Kings County No. 319
Kings Register No. 5120
N. Y. County No. 207
N. Y. Register No. 5-A-128
My Commission Expires March 30, 1935

COMING EVENTS

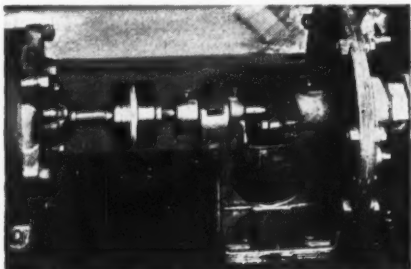
MAY 10-31—INTERNATIONAL METAL INDUSTRIES EXHIBITION to be held at the Commercial Museum in Osaka, Japan. For further information address Agne, Okamoto nr. Kobe, Japan.

MAY 14-15—Annual meeting of the AMERICAN GEAR MANUFACTURERS' ASSOCIATION at the Penn-Lincoln Hotel, Wilkinsburg, Pa. J. C. McQuiston, manager-secretary, Penn-Lincoln Hotel, Wilkinsburg, Pa.

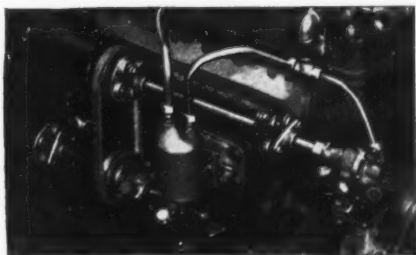
JUNE 6-7—Industry meeting of the GRAY IRON FOUNDRY INDUSTRY at the Hotel Gibson, Cincinnati, Ohio. H. M. Halsted, Jr., executive vice-president, 1010 Public Square Bldg., Cleveland.

POWER TRANSMISSION NEWS

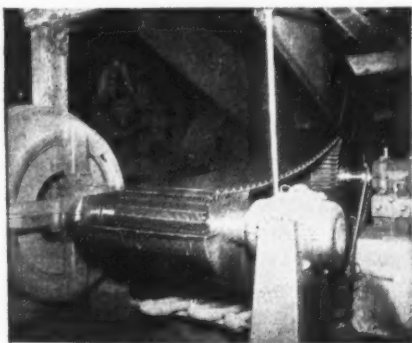
Morse Morflex Couplings are fast becoming popular with industry. Depending upon rubber as a flexing medium these couplings compensate for both angular and parallel misalignment with no measurable



loss of power. The above illustration shows Morflex Couplings with cover used in a large paint factory to connect an electric motor to a centrifugal pump.



Gasoline motor manufacturers are finding Morflex Couplings fit their exacting needs. Three Morflex Couplings are used on the above motor.



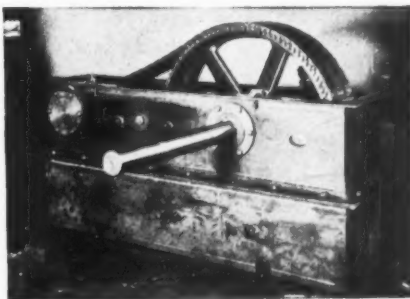
Large Morse Silent Chain installation driving fan in coal mine where sure reliable power transmission is absolutely necessary.

Use Chain Drives

Dependable transmission of power for every type of machine is made possible by the Morse Chain Company.

Chain Drives transmit power without loss, are economical in first costs and in operation and maintenance. Furthermore, they are adaptable to practically any conditions of power, speed or position.

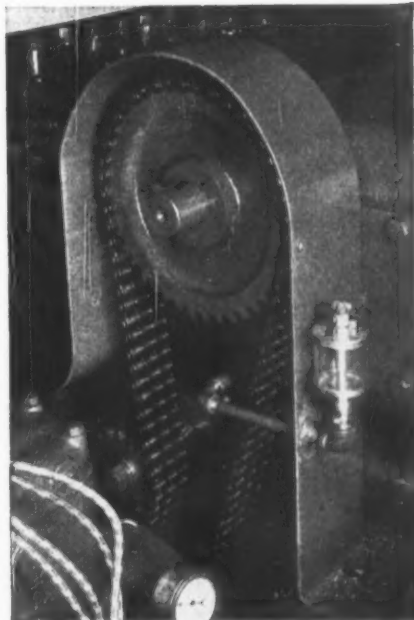
The Morse Chain Company maintains offices in the principal cities staffed with competent engineers who cooperate with industry in the development of more efficient power transmission.



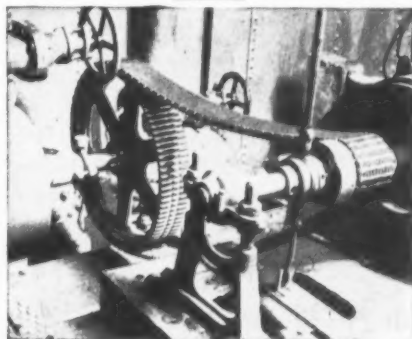
Morse Chain speed reducer with fabricated case—one of five units now successfully being used in large Eastern rubber mills. This type is available with single reduction in any speed ratio.

From Raw Material To Finished Product

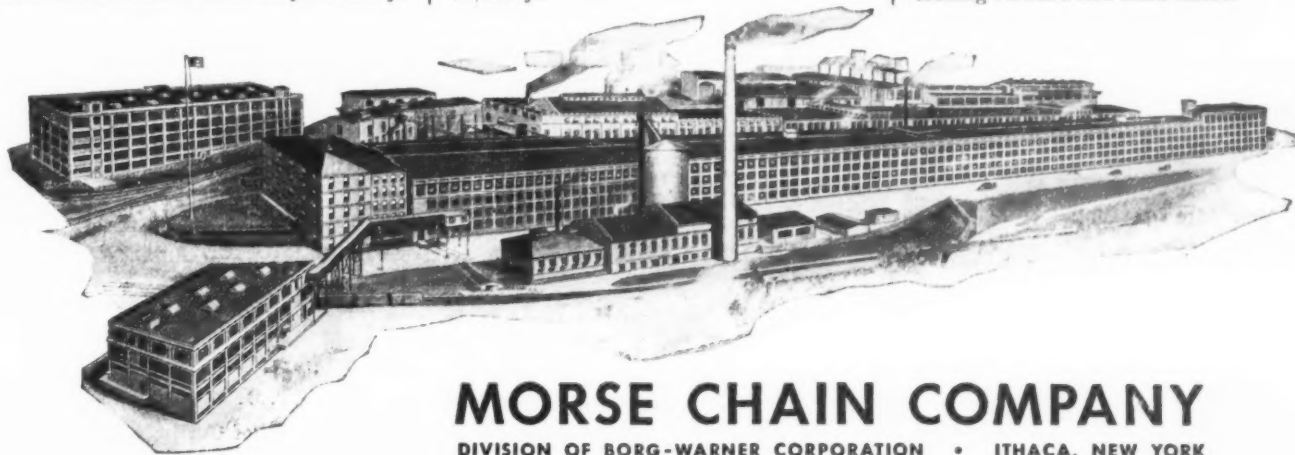
At the bottom of this page is an illustration showing the Morse Chain plant at Ithaca, New York, one of the largest in the world, devoted to the manufacture of power transmission devices. Here production is controlled from raw materials to the finished product. It is complete in every way, rolling mills, foundry, machine shop, complete steel plant, facilities for cold drawing, heat treating and the many other processes necessary for the production of Morse Silent Chains—Roller Chains, Morflex and Standard Couplings, Morse Improved Kelpo Clutches, Sprockets and other Morse Power transmission devices. Another large plant is maintained at Detroit to serve the needs of the automotive industry.



Triple width Roller Chain installation connecting gasoline motor with pump showing use of idler and method of lubrication. Because of the perfected and different construction of Morse Roller Chains, the lubricating oil penetrates to every moving part of the chain both inside and out.



Here is a unique power transmission installation. . . This illustration shows a Morse Silent Chain and Morse Pullmore Clutch between a gas engine and a 750-gallon per minute pump on a canal barge. A radial thrust bearing is mounted on supporting pedestal to eliminate an end-thrust and distortion due to unbalanced condition of barge when loading and unloading forward and stern tanks.



MORSE CHAIN COMPANY

DIVISION OF BORG-WARNER CORPORATION • ITHACA, NEW YORK

MACHINERY, May, 1935—67

Classified Contents of this Number

DESIGN, FIXTURE AND TOOL

- Attachment with Swinging Arm and Master Plate for Milling Curved Grooves—*By F. Server*..... 548
- Tool for Removing Sharp Edges of Holes Bored in Tubesheet—*By Joseph Waitkus* 549
- Gage for Testing Taper of Plug Gages and Reamers—*By C. W. Putnam* 550
- Toolmakers' Universal Drill Jig—*By Peter L. Budwitz* 550
- Milling Machine Units and Fixtures Designed for High Production—*By H. J. Dods* 554

DESIGN, MACHINE

- Indexing Mechanism with Interchangeable Turrets for Either Three or Four Stations—*By Joseph E. Fenno* 539
- Delayed-Movement Mechanism for Machine Slide—*By John A. Honegger* 540
- Mechanism for Obtaining Dwell in Lever Movement—*By Paul Grodzinski* 541

DIEMAKING, DIE DESIGN, AND PRESS WORK

- Die-Casting Dies that Achieve the Impossible—*By Charles O. Herb* 534
- Press Tools for Making Ferrules—*By William C. Betz* 547
- A Problem in Drawing Shells—*By Herman Osswald* 552

HEAT-TREATING METHODS

- Heating, Quenching, and Drawing in Automatic Furnaces—*By J. B. Nealey* 526
- An Experience in Tool Hardening 557

LUBRICATION AND LUBRICANTS

- Hot Bearings Caused by Unclean Containers 531
- Oil Loss in Turbine 552
- The Important Characteristics of a Cutting Fluid 557
- When to Use Oildag Lubricant 559

MANAGEMENT PROBLEMS

- Old Electric Motors, Too, Should Be Replaced.... 525
- Selecting the Right Machine Tool for the Job—*By Walter K. Bailey* 532
- A Means to Control the Fluctuating Value of the Dollar 538
- Building up Friendly Employee Relations 556
- Long Service Records in the Chevrolet Plants.... 580
- G.E. Suggestion System 581
- New Ideas of Employees Aid Management 582
- Color Marking for Steel 582

MATERIALS, METALS, AND ALLOYS

- New Industry Creates Demand for Light Machinery—*By Charles O. Herb* 521
- Bakelite Used for Mounting Metallurgical Specimens 560

- Wrought Iron Increased in Strength by Adding Nickel 560
- Ten Types of Thermostatic Bimetal for Various Temperature Ranges 561
- Monel Metal with a Tensile Strength of 160,000 Pounds per Square Inch 561
- Aluminum Foil Seals Milk Bottles Against Germs And Dirt 561

MEETINGS AND CONVENTIONS

- National Metal Trades Association to Meet in Cleveland 582
- Tool Engineers Elect Officers 582

NEWS OF INDUSTRY

- The Development of the Lathe—An Industrial Motion Picture 528
- Recent Diesel Engine Developments 531
- Canadian Machine Tool Demand 541
- Engineering News Flashes 542
- Industrial Accidents in 1934 551
- Marked Improvement in Industrial Conditions.... 556
- Roller-Bearing Locomotives 559
- Boye & Emmes Co. Celebrates Fortieth Anniversary 579
- A Machine Shop on Wheels 581
- Soviet Machine Tool Industry 581
- Export Trade in Industrial Machinery in 1934.... 582
- News of the Industry 584

SHOP PRACTICE

- New Method of Producing Tracings 528
- Centralizing Cutters in Boring-Bars—*By Edward Prince* 529
- Boring Small Tapered Holes to Close Tolerances.. 530
- Stand for Setting and Storing Valve-Chamber Boring Heads—*By Oliver Herbert* 533
- Diamond Boring of Automobile Pistons—*By C. A. Birkebak* 544
- Quantity Production of Steel Type by Rolling—*By C. W. Hinman* 546
- A Handy Micrometer "Board"—*By Emil A. Schigut* 546
- Aligning Long Lathe Beds 552
- Shop Equipment News 565
- Castings Can be Made Close to Size when Machining with Carboly 579

WELDING AND CUTTING PRACTICE

- Welded-Head Construction for Cylindrical Containers Made from Steel Pipe—*By Charles C. Tomney* 529
- Cutting Rotors from 12-Inch Steel Plate with Oxy-Acetylene 551
- Electric Arc Provides New Type of Cutting Tool.. 558

SHOP EQUIPMENT SECTION

in the study of mechanical working, heat-treatment, extrusion, aging, etc., to determine internal strains. The instrument can be mounted on radiographic X-ray equipment, if desired, for simultaneous use in the inspection of castings or welded pressure vessels.

Danly Large Standard Die Sets

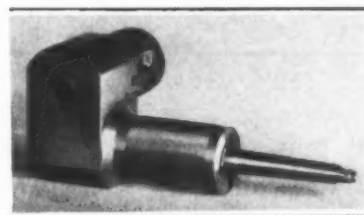
To meet the needs of manufacturers requiring larger standard die sets than those formerly available, the Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago, Ill., has recently introduced a new line of die sets for heavy work. In the past, such large die sets had usually been made special. Substantial economies have been effected by standardizing them.

The types, sizes, and thickness combinations of the new line are based on an extensive survey conducted to de-

termine what could be considered standard for large dies. The sizes range from 10 by 18 inches to 46 by 100 inches and they provide practically unlimited possibilities as to combination. These large die sets are available in either all-steel or semi-steel construction.

Koza Right-Angle Drills

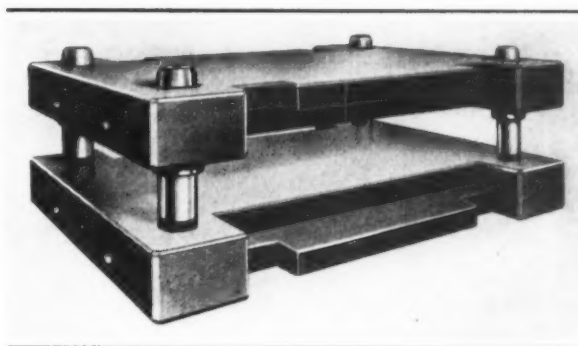
Right-angle drilling units of new design are being introduced to the trade by C. A. Koza, 464 Augustine St., Rochester, N. Y.,



Koza Right-angle Drill with Taper Shank

for drilling in inaccessible places. These units are intended primarily for use with portable electric tools. The accompanying illustration shows the taper-shank type of drilling unit.

These drilling units are made with chrome-nickel steel gears cut integral with the shafts and hardened. The tools are usually made with a screw feed of 1 inch, but feeds of greater length can be provided if desired. Seven sizes are available for drilling holes from 1/8 to 1 1/2 inches. Drilling units of special design can be made to suit the requirements of individual shops.



Die Sets up to 46 by 100 Inches are now Included in the Danly Standard Lines

An Engineering Exhibition One Hundred Years Ago

Just one hundred years ago, in 1835, there was held in London, England, under the auspices of the Society for the Illustration and Encouragement of Practical Science, an exhibition comprising "models of inventions, works of art, and specimens of novel manufactures." A recent number of *Engineering* refers to some of the exhibits, giving an indication of the tremendous advance in engineering knowledge during the past century. For instance, at this exhibit was shown the first gas cooking stove. Various culinary operations were demonstrated at intervals. The flames, however, were rather smoky and inefficient, and apparently the stove was a crude apparatus.

Another exhibit was a model

of "the great American steam raft, *Emma of Troy*." This was a river boat with which experiments had been made in America, a speed of twenty miles an hour having been obtained. The idea embodied in the design was to minimize the resistance by supporting the deck on two long, very narrow tapering hulls, with the paddle wheel between them.

Other exhibitions that excited comment were a large electromagnet; "artificial stone"—Portland cement—discovered by Joseph Aspdin, a bricklayer of Leeds; and an apparatus for warming a room by passing the entering air through an arrangement of steam pipes, one of the earliest conceptions of air-conditioning.

Soviet Exports Trucks and Buses

That the Soviet industry is in a position to export motor trucks and buses is certainly news. A recent number of the *Economic Review of the Soviet Union* mentions that 570 motor trucks and 40 buses manufactured by the Stalin plant in Moscow are being shipped to Turkey. In addition, 9 steamers loaded with machinery and equipment for a large textile mill being constructed for the Turkish government by Soviet engineers recently left the port of Odessa. Soviet engineers are now planning another textile mill in Turkey that will be equipped with Soviet machines. In return, of course, the Soviet government obtains Turkish products of a character not produced in Russia.

NEWS OF THE INDUSTRY

Illinois, Indiana, and Missouri

LAWRENCE J. KLINE has been elected vice-president of the Mercury Mfg. Co., 4118 S. Halsted St., Chicago, Ill., maker of industrial tractors, trailers, lift trucks, and other material-handling equipment. Mr. Kline will continue as general manager of the company, a position he has held for the last seven years.

CHARLES KAUDERER has joined the Clearing Machine Corporation, 6499 W. 65th St., Chicago, Ill., as Michigan representative for the company's line of stamping presses, air cushions, and die duplicators. Mr. Kauderer has been connected with the stamping and die industries for many years.

R. K. LEBLOND MACHINE TOOL CO., Cincinnati, Ohio, has established a direct sales office in Chicago, under the direction of B. N. BROCKMAN, western sales manager, located at 20 N. Wacker Drive, Chicago, Ill.

E. J. BENESCH has been appointed representative of the Barber-Colman Co., Rockford, Ill., in the territory immediately surrounding Rockford. He has been connected with the sales office of the company for many years.

HERBERT F. SAUER, formerly manager of the Cleveland branch of the Electric Storage Battery Co., has been appointed manager of the Chicago branch. WILLIAM P. ROCHE will succeed Mr. Sauer as manager of the Cleveland branch.

E. L. ESSLEY MACHINERY CO., 825 Rees St., Chicago, Ill., has been appointed exclusive sales agent for the Van Norman millers, which have recently been completely redesigned.

ARMSTRONG BROS. TOOL CO., 313 N. Francisco Ave., Chicago, Ill., has recently purchased the line of Ideal chain tongs made by the Carrier Engineering Corporation, Newark, N. J.

A. C. OLANDER has joined the South Bend Lathe Works, 797 E. Madison St., South Bend, Ind., as sales engineer. Mr. Olander was previously connected for several years with the Studebaker Sales Corporation as assistant to the sales promotion and advertising manager.

ROY C. KENDALL has been appointed general sales manager of the Medart Co., St. Louis, Mo., manufacturer of power transmission machinery. Mr. Kendall formerly represented the Medart Co. in the state of Wisconsin.

Michigan and Wisconsin

A. M. JOHNSON, formerly sales manager of the Covell Mfg. Co., Benton Harbor, Mich., has become chief engineer of the Michigan Metal Products Co., Battle Creek, Mich.

DAVID E. ANDERSON, chief engineer of the Bohn Aluminum & Brass Corporation, Detroit, Mich., has just returned from a visit of nearly three months to Great Britain and the European continent. Mr. Anderson visited practically every representative automobile manufacturer in Europe and had an opportunity to observe very closely conditions and tendencies in European plants.

HARNISCHFEGER CORPORATION, of Milwaukee, Wis., and the CATERPILLAR TRACTOR CO., of Peoria, Ill., announce a cooperative arrangement for building Diesel-powered generator sets which will be sold under the name "Harnischfeger-Caterpillar."

New England

K. B. MCEACHRON, research engineer of the General Electric Co., Pittsfield, Mass., whose studies in artificial lightning up to 10,000,000 volts have brought him world-wide recognition, received the Edward Longstreth medal of the Franklin Institute, Philadelphia, on May 15. The award was based on his development of a process for the manufacture of Thyrite, a substance used in more than thirty-five different electric applications, principally for lightning arresters. In this connection, it has saved millions of dollars annually in protecting electric company equipment against losses from lightning damage.

HENRY E. WARREN, president of the Warren Telechron Co., Ashland, Mass., has been selected as the recipient of the 1934 Lamme medal of the American Institute of Electrical Engineers for his outstanding contribution to the development of electric clocks and means for controlling central station frequencies. The award will be made at Cornell University in June. Mr. Warren was also awarded the John Price Wetherill medal on May 15 in recognition of his invention of the Telechron motor.

LEON L. CLORE has joined the sales engineering department of the Machinery Division of the Austin-Hastings Co., Inc., Cambridge, Mass. Mr. Clore has had many years' experience in the equipment

business. His territory will comprise Rhode Island and Worcester County, Mass., and his headquarters will be at the Worcester office.

N. W. PICKERING, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn., sailed on the *Britannic* on April 8 for a two months' trip to Europe. Mr. Pickering is combining a business trip with vacation, and expects to spend some time with the company's representatives in England, France, Sweden, and Norway. He will also visit Germany and Italy.

New York and New Jersey

R. & J. DICK CO., INC., 90 West Broadway, New York City, announces that it has made arrangements with CARTER, MILCHMAN & FRANK, INC., 139 Spring St., New York City, to act as distributing agents in New York for Barry steel split pulleys and "Dickbelt," a Balata belting.

BERNARD H. PORTER has recently joined the technical department of the Acheson Colloids Corporation, located at 444 Madison Ave., New York City. While doing general field research work, he will devote the major part of his time to electrical applications.

LUKENS STEEL CO., Coatesville, Pa., announces the removal of the New York offices of the company to the Chrysler Building, 405 Lexington Ave.

WALSER AUTOMATIC TIMER CO., announces the removal of its offices to the Graybar Building, 420 Lexington Ave., New York City.

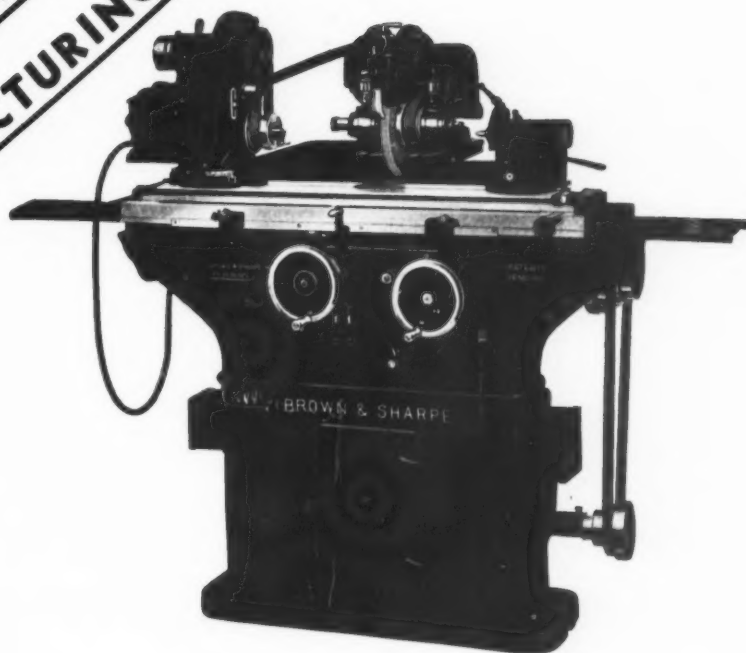
JOHN J. CROWE, engineer in charge of apparatus research and development for the Air Reduction Sales Co., with labora-



Keystone View Co.

**John J. Crowe, Newly Elected
President of the American
Welding Society**

Nos. 1, 2, 3, & 4
FOUR VERSATILE
SELF-CONTAINED UNITS FOR
TOOL WORK AND MANUFACTURING



—the Increasingly Popular

BROWN & SHARPE

MOTOR DRIVEN UNIVERSAL GRINDING MACHINES

Compact . . . Convenient . . . Accurate

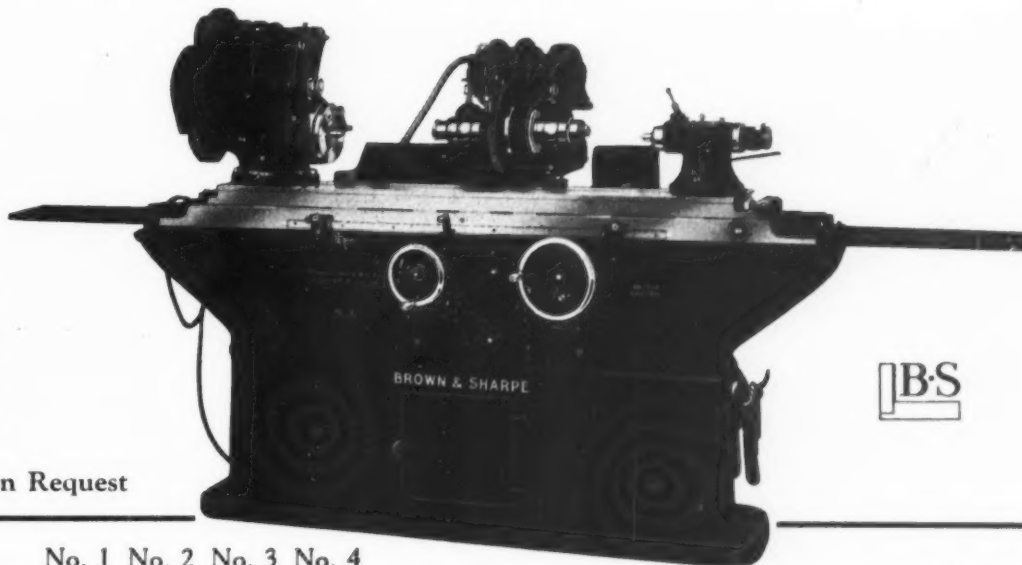
—with Individual Headstock Drive for work on live or dead centers—Tool and Cutter grinding—Internal grinding—Production grinding

May we send details and explain the possibilities of these “truly universal” cost-cutting machines?

— Belt Driven

machines can be furnished in corresponding sizes where countershaft drive is wanted

Details on Request



| CAPACITIES— | | No. 1 | No. 2 | No. 3 | No. 4 |
|------------------------|--|-------|-------|-------|-------|
| Diameter Centers Swing | | 10" | 12" | 12" | 12" |
| Length Centers Take | | 20" | 30" | 40" | 60" |

Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

MACHINERY, June, 1935—63

tories located in Jersey City, N. J., was elected president of the American Welding Society at the last annual meeting, held at the Hotel Pennsylvania in New York City on April 25. He has been senior vice-president since 1933, and has been a director of the Society for the last ten years. Mr. Crowe has had a wide experience as a metallurgist, having held important posts with the Bureau of Standards, the United States Navy Department, and Temple University. He has also acted as consulting engineer on many important developments. He has written a number of papers on metallurgical subjects and on the use of oxygen and oxy-acetylene equipment, and has taken out several patents applying to oxy-acetylene equipment.

Ohio

N. L. DEUBLE, metallurgist of the Republic Steel Corporation, Massillon, Ohio, recently delivered an address before a meeting of the Chicago Chapter of the American Society for Metals on the subject of metallurgical inspection.

F. A. HURCOMB has recently joined the Federal Machine & Welder Co., Warren, Ohio, as assistant manager in charge of development and sales. Mr. Hurcomb was formerly superintendent of the body division of the Studebaker Corporation, South Bend, Ind.

LEE WRIGHT has been appointed sales representative for the Republic Steel Corporation, Youngstown, Ohio, with headquarters at 401 Atlas Bldg., Salt Lake City, Utah.

PHILIP E. BLISS, president of the Warner & Swasey Co., Cleveland, Ohio, and CHARLES J. STILWELL, vice-president, were recently awarded gold watches, in recognition of twenty-five years of service with the company, by Ambrose Swasey, chairman and co-founder. Mr. Bliss, a former president of the National

Machine Tool Builders' Association and a former director of the National Industrial Conference Board, entered the company's employ June 5, 1910, as an accounting clerk. Appointed cashier in 1912, he occupied in rapid succession the posts of auditor and treasurer, and was elected a director in 1919. He became president in 1928. Mr. Stilwell, now president of the National Machine Tool Builders' Association, entered the company's employ as a special apprentice July 1, 1910. After representing the company in New York and Europe, he became assistant to the vice-president in 1916 and foreign sales manager shortly after the close of the World War. He was named sales manager in 1922 and vice-president seven years later. Presentation of the watches by Mr. Swasey to the company's two ranking executive officers marked the sixty-first and sixty-second awards made to employees that have been in the company's service for twenty-five years.

Pennsylvania and Maryland

LEEDS & NORTHRUP Co., 4900 Stenton Ave., Philadelphia, Pa., and GEORGE KENT, LTD., of Great Britain, have made an agreement regarding the sale of industrial electro-chemical instruments and certain types of flow meters. These two companies will act as exclusive agents for each other in their respective countries for the sale of the instruments referred to; but it is understood that no other of their products are included in the arrangement.

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, announces the removal of its Philadelphia district sales office from the Fidelity-Philadelphia Trust Bldg. to the Broad St. Station Bldg., 1617 Pennsylvania Blvd. Two subsidiaries of the company, the BERGER MFG. Co. and the UNION DRAWN STEEL Co., will also be located at the new address. J. B. DEWOLF continues in charge of the office as district sales manager.



A. J. O'Leary, Assistant to General Manager of Sales, Lukens Steel Co.

A. J. O'LEARY has been appointed assistant to general manager of sales of the Lukens Steel Co., Coatesville, Pa. Prior to joining the Lukens organization in 1916, Mr. O'Leary was with the Pennsylvania Railroad and the Alan Wood Steel Co.

J. E. HOLVECK has been appointed special sales engineer of the Worthington Pump & Machinery Corporation, Harrison, N. J., operating from the Pittsburgh office and also covering the territories of Cleveland, Detroit, Chicago, and Buffalo.

DRAFTO Co., maker of portable drafting machines, has moved from Meadville, Pa., to its new plant at Cochran, Pa.

T. A. CANTY, Baltimore, Md., distributor of arc welding equipment and supplies manufactured by the Lincoln Electric Co., Cleveland, Ohio, has found it necessary, due to increasing business, to move from 116 E. Center St., to larger quarters at 1023 Cathedral St.



Ambrose Swasey, 88-year-old Founder and Chairman of the Warner & Swasey Co., Machine Tool and Astronomical Instrument Builders (Center), Presenting Gold Watches to Philip E. Bliss, President of the Company (Left), and Charles J. Stilwell, Vice-president (Right), in Recognition of their Completion of Twenty-five Years Service with the Organization.

BETTER PARTS *at* LOWER COST!



Try out seamless tubing in your shop and find out for yourself what you can do with it in making parts. Be satisfied, at least, that you have given this material a trial in the interest of economy and a better finished product. NATIONAL-SHELBY Seamless Tubing comes in practically any size and wall-thickness which you will require and in various shapes to save you operations. Grades and treatments of steel are furnished to meet almost any use. To use seamless mechanical tubing for making parts is to be up-to-the-minute in efficient manufacture and cost saving. Sometimes just a single cut or light grinding may be all that is needed to make your part, or perhaps simple swaging, expanding, or upsetting, either from hot-finished or cold-drawn tubing. The finished part will be of fine, uniform steel structure with exceptional strength and no excess weight.

Why not send in your blue print or specification and let us consider your problem? It may result in better parts for you and at lower cost. Also, send for Seamless Handbook.

NATIONAL TUBE COMPANY • Pittsburgh, Pa.

Pacific Coast Distributors—COLUMBIA STEEL CO., San Francisco, Calif.
Export Distributors—UNITED STATES STEEL PRODUCTS CO., New York, N. Y.

United States Steel Corporation Subsidiary

Some of the things you can do with NATIONAL- SHELBY Seamless Tubing

| | |
|------------|------------|
| TWIST IT | BEND IT |
| WELD IT | COIL IT |
| THREAD IT | UPSET IT |
| MACHINE IT | TEMPER IT |
| GRIND IT | FLANGE IT |
| SWAGE IT | EXPAND IT |
| COAT IT | FLATTEN IT |

SEAMLESS MECHANICAL TUBING

Texas and Georgia

G. G. McDONALD has been appointed sales representative of Bliss & Laughlin, Inc., Harvey, Ill., manufacturers of cold-finished bar steels and shafting. Mr. McDonald's territory will include Arkansas, Oklahoma, Texas, and the boundary cities of Texas and Louisiana. The district office will be located at 3502 Rose-dale St., Dallas, Tex.

R. Y. MACINTYRE, formerly representative in Memphis, Tenn., of the Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., has been transferred to the company's district sales office and warehouse in Dallas, Tex., where he will assist E. G. Wendell, the local manager.

BROWN INSTRUMENT CO., Philadelphia, Pa., manufacturer of indicating, recording, and controlling instruments, and the MINNEAPOLIS-HONEYWELL REGULATOR CO., Minneapolis, Minn., manufacturer of control systems and regulators, have opened a joint office at the 101 Marietta St. Bldg., Atlanta, Ga., to serve the Southeast. WESLEY R. MOORE, for a number of years district manager of the Brown Instrument Co., is manager in charge.

* * *

Age of Workers in Automobile Plants

In May MACHINERY, on page 580, the length of service of some of the employees with the Chevrolet Motor Co. was referred to. Our attention has been called to a similar condition in the Studebaker plants, refuting definitely the snap-judgment idea so often voiced that the automobile industry will not employ men over forty years of age. In the Studebaker plants, the average age of the employees is about forty years; and there are more men employed who are over fifty years old than there are men under thirty.

* * *

I should like to see bankers uniting to secure that the condition under which loans are raised and lent should be in the interest of the borrower and investing public. I should like to see a similar development in every main sphere of activity. I should like these separate organizations to be linked to each other and to the machine of public government through economic councils—national and international. So only, with the aid of all the available constructive intelligence in every sphere, will what I may call "governance," or the defense of public interests, be adequate for its task under the infinitely complex conditions of modern life.—*Sir Arthur Salter, Former Director of the Finance and Economic Sections of the League of Nations*

648-D—MACHINERY, June, 1935

NEW BOOKS AND PUBLICATIONS

SAE HANDBOOK. 672 pages, 6 by 9 inches. Published by the Society of Automotive Engineers, Inc., 29 W. 39th St., New York City. Price to non-members of the Society, \$5.

The 1935 SAE Handbook gives the results of three important SAE standards projects completed during the year 1934, and contains many important revisions and additions. Of the new material, perhaps the most important is a complete revision of the iron and steel specifications and the non-ferrous metal specifications. Other new material includes revised tables of screw threads and bolts and nuts which have been established as American Standards under the sponsorship of the SAE and the A.S.M.E.

A complete explanation is given of the three cost classifications or cost record plans designed to serve different sizes and types of motor vehicle fleet operations. A set of forms that is expected to find wide use in the automotive industry provides for uniform reporting and filing of motor vehicle lubrication data. Data has been included covering the oval diameters for tanks on fuel tank trucks, prepared through the cooperation of the American Petroleum Institute and a committee of the tank manufacturers. New information on the method of testing storage batteries has also been included. The complete report of the Automotive Transportation Code Committee has been published in the new edition of the Handbook as a guide in connection with motor vehicle regulation.

MANUAL FOR FOREMANSHIP DEVELOPMENT. By the Industrial Relations Department, Westinghouse Electric & Mfg. Co. 60 pages, 8 3/4 by 11 inches. Published by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Price, \$1.

This is a paper-bound, process-printed manual intended as a guide in developing the supervisory forces in industry. It contains a simplified plan for the training of foremen and other supervisors, and is based on the experience of the Westinghouse Electric & Mfg. Co. and that of other companies who have been active in supervisory training. It is intended both for the leaders of the training group and for the members being trained. In addition to suggesting methods and technique for conducting training courses, it outlines a series of thirty-eight conferences on major problems in foremanship. The course is especially suited to industrial organizations that are not in a position to develop a foremanship training course of their own and yet feel the need of carry-

ing on such a program; but it is also of value to anyone interested in foremanship training methods.

THE BOOK OF STAINLESS STEELS. Edited by Ernest E. Thum. 787 pages, 6 by 9 inches. Published by the American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio. Price, \$5.

This is the second edition of a comprehensive work on stainless steels and other corrosion-resisting and heat-resisting chromium alloys. The book has been written primarily to present data on the fabrication, properties, and utilization to consumers of the heat- and corrosion-resisting alloys, rather than to furnish information for producers of these alloys. It has been completely revised and much new material has been added, among which may be mentioned a chapter on the arc welding of high-chromium irons; several chapters on various types of castings; a chapter on 29 per cent chromium, 9 per cent nickel alloys; a chapter on the requirements of the petroleum refineries; and an index of trade-named alloys produced in the United States.

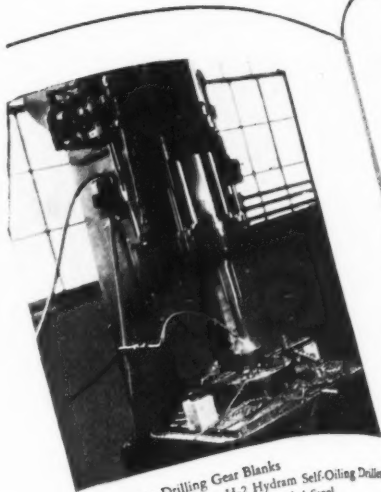
NEWARK GEAR DECIMAL EQUIVALENTS. 51 pages, 6 by 9 inches. Published by the Newark Gear Cutting Machine Co., Inc., 69 Prospect St., Newark, N. J. Price, \$1.50.

The purpose of this book is to facilitate finding the change-gears in cutting helical gears or other helical leads. It contains a table of 3859 fractions with their decimal equivalents, ranging from 0.002 to 0.999999 inch. The book also contains a table of one-tooth leads for different angles ranging from 5 minutes to 90 degrees in increments of 5 minutes, for 1 normal diametral pitch and 1-inch normal circular pitch. With the angle of a tooth given, the lead can be obtained from this table, and when the lead is obtained, the change-gears are found by reference to the decimal equivalent table.

ENAMELS. By Andrew I. Andrews. 410 pages, 6 by 9 inches. Published by the Twin City Printing Co., Champaign, Ill. Price, \$5.50.

This book discusses the preparation, application, and properties of porcelain enamels. The aim in preparing the book has been to present the technology of enameling in a systematic manner suited to the needs of both the industrial man and the student. It contains a practical discussion of all the processes, from the raw materials to tests of the completed product. Practical solutions are presented to countless everyday problems. Sixty-two tables are included, summarizing much valuable data for convenient reference.

For Fast, Clean DRILLING



Operation: Drilling Gear Blanks
Machine: Barnes No. H-2 Hydram Self-Oiling Driller
Material: SAE 3140 Chrome Nickel Steel
Size of Drill: 2 1/2 inches
Lubricant: 1 part Sunoco to 20 parts water
Courtesy of
Barnes Drill Company
Rockford, Ill.



Operation: Resharpen cutting lips of 1 in. diameter twist drills
Machine: Sellers No. 2B Drill Grinder
Material: High Speed Steel
Stock Removed: 1/8 inch off each lip
Wheels: 8 in. x 2 1/4 in. x 1 1/4 in. face. Special shape.
Coolant: 1 part Sunoco to 40 parts water.
Courtesy of
William Sellers & Co., Inc.
Philadelphia, Pa.

WHEN Sunoco Emulsifying Cutting Oil — with its superior cooling and lubricating qualities — is relied on in the drilling operations, shop records testify to the excellent and accurate work achieved. That's why Sunoco is chosen so widely and consistently . . . Its users are legion!

Sunoco Helps Drill More Holes Per Grind

Because drills can cut so fast and clean with Sunoco "on the job," definite results are seen in the greater number of holes drilled for each tool grind. Further, these holes are of accurate size,

and truly cylindrical. Rough holes are eliminated and breaking down of outer corners of the cutting edges is reduced to a minimum.

Drill Life is Lengthened

Observations of drilling operations in many shops over long periods of time indicate unmistakably other advantages which follow the use of Sunoco. Drills clean easily; chips don't freeze on the drill; there's no clogging; no burning. Longer drill life is noted — and power costs are lowered. These are not generalizations; they are actual results widely achieved by Sunoco.

... Use

SUNOCO

EMULSIFYING
CUTTING OIL

SUN OIL COMPANY, Philadelphia, Pa.

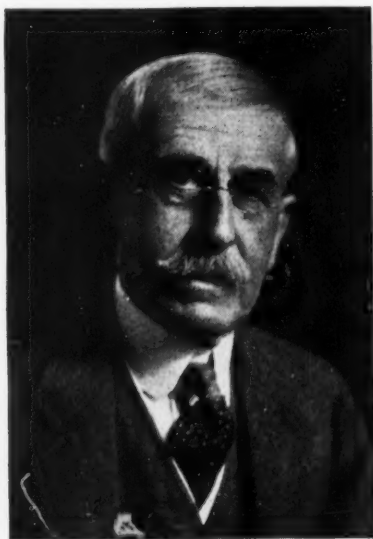
Subsidiary Companies: Sun Oil Co., Ltd., Montreal and Toronto; British Sun Oil Co., Ltd., London, Eng.

• Manufacturers who have taken advantage of our cutting oil engineering service have found such cooperation and consultation worth while. To solve your drilling or other metal working problems, we invite you to ask for the help of our skilled engineers. That will involve not the slightest obligation on your part!

OBITUARIES

Henry F. Wanning

Henry F. Wanning, director and member of the executive committee of the Farrel-Birmingham Co., Inc., and president of the former Birmingham Iron Foundry, died April 28 at his home in Shelton, Conn. Mr. Wanning was born in Webster, Mass., on March 30, 1846. Because of the early death of his father, who was a successful merchant in Webster, he began at a very early age to



Henry F. Wanning

earn his living in his native city. Soon he moved to New York, where he secured work with the New York Steel Co.

On September 30, 1865, young Henry Wanning went to Derby, Conn., then Birmingham, carrying with him a letter from the steel company's president to the president of the Birmingham Iron Foundry. He obtained a position with this company as bookkeeper. Here his marked ability was soon recognized, and he was advanced, successively, to the offices of secretary, treasurer, and vice-president. In twenty-six years, in 1891, he was elected president, which position he held for thirty-seven years, until his company became merged with the Farrel Foundry & Machine Co. of Ansonia, Conn. Mr. Wanning was a director and a member of the executive committee in the new corporation, the Farrel-Birmingham Co., Inc., up to the time of his death.

Mr. Wanning was a man of wide interests, and his business activities were not confined to the Farrel-Birmingham Co. He was chairman of the board of the Birmingham National Bank and a trustee of the Home Trust Co.

Albert Man Powell

Albert Man Powell, at one time president of the Woodward & Powell Planer Co., Worcester, Mass., died in Worcester on May 6, at the age of seventy-eight years. Mr. Powell was a graduate of the Worcester Polytechnic Institute, class of 1878. In 1881 he formed, with the late Joseph H. Wight, the Wight & Powell Co., which was later reorganized as A. M. Powell & Co., builders of lathes and planers. In 1884, the company was again reorganized as the Powell Machine Tool Co., which, in 1886, was sold to the L. W. Pond Machine Co. In 1887, Mr. Powell organized the Powell Planer Co. in conjunction with the late George W. Fifield and the late Edward M. Woodward. In 1899, this company erected a new shop and changed the name to the Woodward & Powell Planer Co., Mr. Fifield having withdrawn some years previously. In 1907, Mr. Powell sold his interest in this company and, with his two sons, organized the Powell Tool Co. to build the Powell "Hy-Speed-Cut" planer. Two years later this company moved to Fitchburg, Mass., and reorganized under the name of the Powell Machine Co. In 1916, the company moved to Worcester, and its planers were built at the factory of the Standard Plunger Elevator Co. In 1920, Mr. Powell retired from active business.

MAURICE I. JOHNSON, for many years treasurer and latterly vice-president of Gisholt Machine Co., Madison, Wis., died suddenly at his home, on May 13, aged fifty-eight. He was the youngest of the four brothers for whom their father, John A. Johnson, founded the Gisholt company in 1887. Of these, Hobart S. Johnson, president of the company, survives him; the two older brothers, Frederick A. and Carl A. having died previously. Mr. Johnson received his education at the University of Wisconsin and West Point Military Academy. Aside from his duties as an officer of the company, he gave most of his attention to the management of the Gisholt foundry.

* * *

Trade—Our Major Problem

Confused as the national scene may be in its variegated pattern, when boiled down to its fundamentals, America's problem is as old as the world. More, it is a world problem. It is, as Ramsay MacDonald puts it, "of how to keep the cupboards full." What will keep the cupboards full? The answer is, trade, the thing most earnestly prayed for today; trade, the exchange of goods and services, which is "business activity," two words which always catch the headlines of common interest.—Merle Thorpe in *Nation's Business*

Yet the chief aim of the governments of the world seems to be to throttle trade.—*Commerce and Finance*

COMING EVENTS

JUNE 6-7—Industry meeting of the GRAY IRON FOUNDRY INDUSTRY at the Hotel Gibson, Cincinnati, Ohio. H. M. Halsted, Jr., executive vice-president, 1610 Public Square Bldg., Cleveland.

JUNE 16-21—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 19-21—Summer meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS to be held in Cincinnati, Ohio. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

JUNE 24-28—Thirty-eighth annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Book-Cadillac Hotel, Detroit, Mich., in conjunction with an exhibit of testing apparatus and related equipment. Secretary's address, 260 S. Broad St., Philadelphia, Pa.

JUNE 25-27—GREAT LAKES POWER SHOW on the Steamer *Seeandbee*, exhibiting at Buffalo, June 25; at Cleveland, June 26; and at Detroit, June 27. Ernest H. Smith, manager, 3910 Carnegie Ave., Cleveland Ohio.

JULY 15-20—INTERNATIONAL CONGRESS FOR SCIENTIFIC MANAGEMENT in London, England. For further information, address Industrial Development Association, British Empire Bldg., 620 Fifth Ave., New York City.

AUGUST 19-23—Convention of the AMERICAN FOUNDRYMEN'S ASSOCIATION at Toronto, Canada, with headquarters at Hotel Royal York. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

SEPTEMBER 11-21—MACHINE TOOL EXPOSITION to be held in Cleveland, Ohio, under the auspices of the National Machine Tool Builders' Association, 1220 Guarantee Title Bldg., Cleveland, Ohio.

SEPTEMBER 18-20—Convention of the NATIONAL INDUSTRIAL ADVERTISING ASSOCIATION at Pittsburgh, Pa.; headquarters, William Penn Hotel. Further information can be obtained by addressing W. J. Ramsey, Industrial Advertising Council, P. O. Box 1198, Pittsburgh, Pa.

SEPTEMBER 30-OCTOBER 4—NATIONAL METAL EXPOSITION AND CONGRESS under the auspices of the American Society for Metals to be held in the International Amphitheatre, 43rd and Halsted Sts., Chicago, Ill. W. H. Eisenman, secretary, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

New **BAKER MACHINE**

FOR MOTOR BLOCK OPERATIONS

Combining Accuracy and Handling Speed

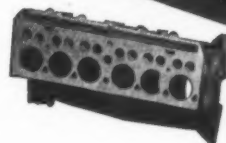
A feature of this machine is a new hydraulic pump which makes possible a most efficient cycle. A more rapid traverse, a two speed cycle, controlled by foot treadle gives a coarse feed, an automatic change to fine feed, a dwell for facing with a time interval and then an automatic return. Any production executive can appreciate the resulting speed and ease of operation with which the machine turns out the work.

The operations include second boring and reaming of valve guide holes, finish boring of valve throats, and rough chamfer of valve seats. Precision is required as well as speed.

The machine is of simplified design with well ribbed column and ample depth front and rear for adaptation of large multiple head.

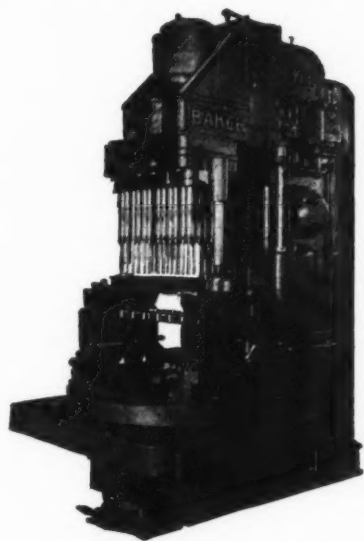


No. 30 V H



Perhaps your production problems can be solved by a Baker engineered machine. Let us check a sample or a blue print of the work. Your inquiry will have our prompt attention.

The complete tooling is by Baker, including table, fixtures and multiple head. Outstanding features are the supporting of tools above the cut in ample size bushings and lower piloting in addition. A two station hand indexed table allows two operations to be performed simultaneously.



BAKER BROTHERS, INC., TOLEDO, OHIO

★ BAKER ★

Classified Contents of this Number

DESIGN, FIXTURE AND TOOL

- Combination Pilot and Clamp for Facing and Grooving Tool—*By Charles C. Tomney*..... 611
- Clamp that can be Positioned and Tightened with One Movement—*By Robert H. Holton*..... 612
- Handling an Over-Size Profile Milling Job on a Medium-Size Machine—*By F. Server*..... 614

DESIGN, MACHINE

- Applications of Ball Bearings to Live Centers—*By H. W. Holdsworth*..... 597
- Rotary Reversing Mechanism for Varying Angular Movement and Dwell—*By J. E. Fenno*..... 603
- Mangle Gear Mechanism for Changing Direction of Rotation 604
- Long Rectilinear Movement Having Constant Velocity and Rapid Reversal—*By F. E. Judson*.... 604
- The Transitorq—a New Gearless Variable-Speed Transmission 624

DIEMAKING, DIE DESIGN, AND PRESS WORK

- Making Molds for Plastic Materials by the Electroplating Process—*By Herbert Chase*..... 590
- Adjustable Die-Casting Dies for Parts of Different Dimensions—*By Charles O. Herb*..... 593
- Using Compressed Air to Strip Shells from Forming Punch and Die—*By William C. Betz*..... 612
- Combination Cutting-Off and Forming Die—*By Eugene L. Soltner*..... 613

HEAT-TREATING METHODS

- Maintaining Uniform Temperature in Oil Quenching Bath 615

MANAGEMENT PROBLEMS

- Increasing Use of Machinery and Industrial Employment Go Together 591
- Going Ahead in Spite of Obstacles—a Good American Doctrine 602
- A Successful Engineer Must Also Be a Good Executive 602
- Where Planning and Budgeting Have Proved Their Value 602
- The Only Road to National Recovery—*By Ralph E. Flanders*..... 618
- International Business Machines Corporation Air-Conditions Large Machine Shop..... 622

MATERIALS, METALS, AND ALLOYS

- Applications of Nickel Alloy Steels and Cast Irons in the Tool and Die Field—*By J. W. Sands*.... 592
- A New Type of Plating Anode..... 608

- Rubber Pads for Power Press Work—*By F. L. Haushalter*..... 615
- Getting Results from Haynes Stellite—*By J. C. Huston*..... 623
- Republic "Double-Strength" Steel for Transportation Equipment 628
- Rubber Protective Coating Applied Like Paint... 628
- Monel Metal with a Hardness up to 350 Brinell.. 629
- A New Corrosion-Resisting Alloy of High Tensile Strength 629

MEETINGS AND CONVENTIONS

- Cleveland Meeting of National Metal Trades Association 596
- Testing Materials Society to Meet in Detroit.... 605
- Gear Manufacturers' Convention 617

NEWS OF INDUSTRY

- The British Machine Tool Industry..... 589
- Engineering News Flashes..... 600
- Soviet Purchases in First Quarter..... 610
- Massachusetts Tech Offers New Cooperative Course in Mechanical Engineering 627
- Exports of Industrial Machinery are Steadily Increasing 627
- Industrial Conditions Continue to Show Marked Improvement 632
- Soviet Railroad Developments..... 632
- News of the Industry..... 648-B

SHOP PRACTICE

- Tractors and Trailers Keep Work Moving in Chevrolet Plants—*By Charles O. Herb*..... 585
- Precision Boring as a Production Operation—*By C. A. Birckbak*..... 606
- Milling Semicircular Surfaces to Fit Each Other—*By Oliver Herbert*..... 610
- Making Cash-Register Parts from Cold-Drawn Steel Sections 610
- Cutting Lubricant for "K Monel" Metal Alloy.... 615
- Lubrication of Die-Casting Machines 626
- New Shop Equipment..... 633

WELDING PRACTICE

- American Welding Society Issues New Welding Codes 599
- Welding Improves Coal Loading Equipment..... 609
- Cast Versus Welded Structures..... 616
- Welded Safety Equipment..... 627

BOOTH 27



ON EXHIBIT— A representative line of modern, efficient, cost-cutting machine and tool equipment of vital interest to the manufacturer who requires accuracy of product at low unit cost. May we show you this equipment at Booth 27? Brown & Sharpe Mfg. Co., Providence, R.I., U.S.A.

BROWN & SHARPE

NEW BOOKS AND PUBLICATIONS

CORPORATION LAW FOR OFFICERS AND DIRECTORS. By William J. Grange. 904 pages, 6 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, \$6.

This book is intended to be a guide to the correct procedure in conducting corporate affairs. It tells just what it is necessary to know and do at every stage of a corporation's existence in order to handle its affairs quickly, correctly, and in conformity with all the latest legal requirements. It covers such factors as the duties and liabilities of officers, directors, and stockholders; meetings and how to conduct them; by-laws, with numerous illustrative provisions from representative companies; problems met when a business extends into other states; stock transfers; corporation taxes; proceedings in bankruptcy, insolvency and dissolution; reorganization, including recent developments. Special attention is given to the problems peculiar to small or close corporations, including the extent to which they can dispense with legal formalities. At every point a clear statement is given of the latest law that applies.

CAST METALS HANDBOOK. 500 pages, 6 by 9 inches. Published by the American Foundrymen's Association, 222 W. Adams St., Chicago, Ill. Price, \$4.

This book, which is believed to be the first handbook devoted exclusively to the industrial application of cast metals, covers all classes of cast metals, including steel, malleable iron, gray iron, and non-ferrous metals. The handbook is divided into sections on recommendations to designers of castings; recommendations to buyers of castings; cast iron; malleable iron; cast steel; and non-ferrous alloys. Each division of the various classes of cast materials contains information on mechanical properties, physical constants, ranges of composition, properties at different temperatures, specifications, heat-treatment, applications and uses of both plain and alloy materials. Information is also given on materials that resist corrosion and heat.

REPORT OF COMMITTEE ON SHOP POLICY AT ARMOUR INSTITUTE OF TECHNOLOGY. 26 pages, 6 by 9 inches. Published by the Armour Institute of Technology, Chicago, Ill.

This report includes a survey of practice in shop instruction in the principal colleges of engineering in America, together with recommendations for the new shop courses that are to be inaugurated at the Armour Institute next fall.

AMERICAN STANDARD JIG BUSHINGS. One of a Series of Standards for Small Tools and Machine Tool Elements. 6 pages, 8 by 10 1/2 inches. Published by the American Society of Mechanical Engineers and the Society of Automotive Engineers, 29 W. 39th St., New York City, in collaboration with the National Machine Tool Builders' Association. Price, 35 cents.

AMERICAN STANDARD SCREW THREADS FOR BOLTS, NUTS, MACHINE SCREWS, AND THREADED PARTS. 42 pages, 8 by 10 1/2 inches. Published by the American Society of Mechanical Engineers and the Society of Automotive Engineers, 29 W. 39th St., New York City. Price, 60 cents.

FACTORS AFFECTING FOREIGN TRADE POLICY. 26 pages, 8 by 10 1/2 inches. Published by the Department of Commerce, Washington, D. C.

COMING EVENTS

AUGUST 19-23—Convention of the AMERICAN FOUNDRYMEN'S ASSOCIATION at Toronto, Canada, with headquarters at Hotel Royal York. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

SEPTEMBER 11-21—MACHINE TOOL EXPOSITION to be held in Cleveland, Ohio, under the auspices of the National Machine Tool Builders' Association, 1220 Guarantee Title Bldg., Cleveland, Ohio.

SEPTEMBER 18-19—Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS to be held at the Hotel Statler, Cleveland, Ohio, in connection with the National Machine Tool Show.

SEPTEMBER 18-20—Convention of the NATIONAL INDUSTRIAL ADVERTISING ASSOCIATION at Pittsburgh, Pa.; headquarters, William Penn Hotel. Further information can be obtained by addressing W. J. Ramsey, Industrial Advertising Council, P. O. Box 1198, Pittsburgh, Pa.

SEPTEMBER 30-OCTOBER 4—NATIONAL METAL EXPOSITION AND CONGRESS under the auspices of the American Society for Metals to be held in the International Amphitheatre, 43rd and Halsted Sts.,

Chicago, Ill. W. H. Eisenman, secretary, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

NOVEMBER 18-20—Twenty-second NATIONAL FOREIGN TRADE CONVENTION of the National Foreign Trade Council in Houston, Tex. Secretary, Lindsay Crawford, National Foreign Trade Council, 26 Beaver St., New York City.

DECEMBER 2-7—FIFTEENTH EXPOSITION OF CHEMICAL INDUSTRIES at the Grand Central Palace, New York City.

OBITUARIES

Walter Frank Dixon

Walter Frank Dixon, works manager of the Elizabethport, N. J., plant of the Singer Mfg. Co., and vice-president of the Diehl Mfg. Co., the electric division of the Singer Mfg. Co., died June 18 at the age of seventy years. Mr. Dixon was born in England. After having been employed by various firms in the United States, he became chief engineer of the locomotive department of the Sormovo Works in Russia. In 1900, he became manager of the Singer Mfg. Co.'s plant at Podolsk, Russia, remaining there until 1917. He returned to the United States in 1918 and became works manager at the Elizabethport plant in 1920, which position he held until his death.

Frank O. Wells

Frank O. Wells, co-founder of the firm of Wells Bros., at Greenfield, Mass., which, with several other plants, was consolidated in 1912 to form the Greenfield Tap & Die Corporation, died June 23 at the age of eighty years. Mr. Wells was president of the Greenfield Tap & Die Corporation for the first seven years after the consolidation, and then held the post of vice-president for several years. In 1924, he founded the Wells Tap & Die Co., and also was the owner of the Wells Mfg. Co. He was a member of the National Screw Thread Commission.

John Bath

John Bath, president and treasurer of John Bath & Co., Worcester, Mass., and well known in the mechanical industries for his developments in grinding machinery, ground-thread taps, and precision measuring tools, died July 9 at the age of sixty-nine years. He established the company bearing his name twenty-three years ago; previously, he was active in the development of machine tools, especially grinding machinery.

ADVERTISEMENT—Each item on this page is a paid advertisement

MACHINE TOOLS GO MODERN WITH CHAIN DRIVES

At the Machine Tool Show (and surely you will be there) you'll quickly realize the preference Machine Tool Manufacturers have for chain drives. Although proved in use over a period of many years, this type of transmission is really the modern drive. No other drives have been discovered that are as reliable, positive, efficient and long-lived as silent or roller chain drives.

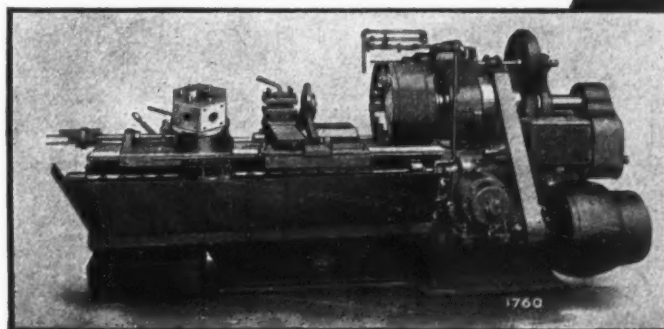
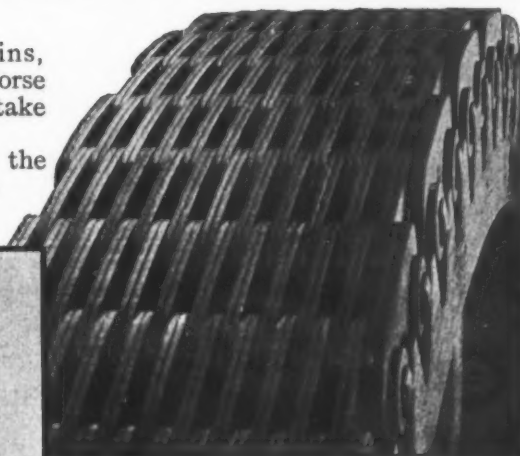
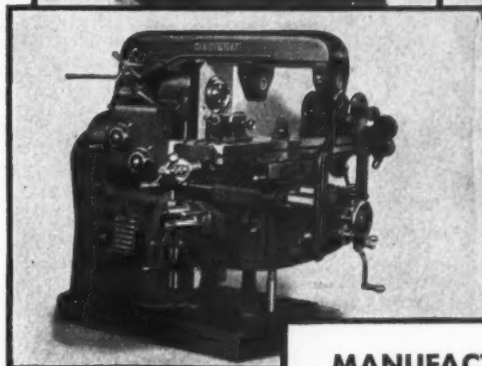
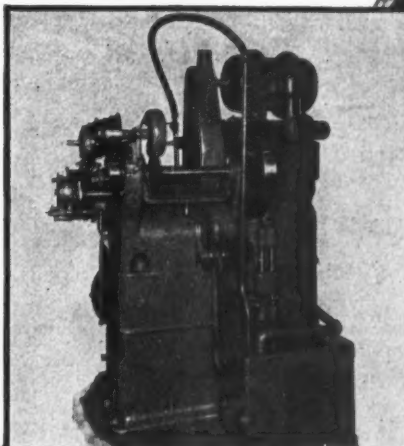
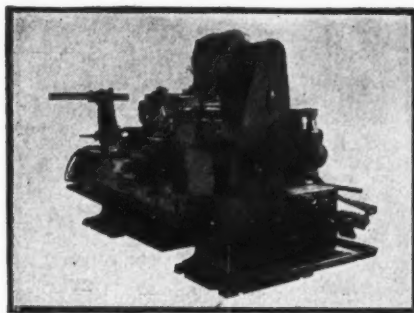
Modernization—the topic of the show, can well begin with a thor-

ough consideration of power transmission in your own plant, as well as on the tools you make. Increased production at lower costs—the real result of modernization, has come from a study of this production factor.

You'll find it worth your while to visit the Morse Chain Exhibit at the show—Morse, as you know, is one of the largest manufacturers

of silent chains, roller chains, couplings, and clutches. Morse engineers will be on the job to take good care of you.

But, by all means, visit the Machine Tool Show at Cleveland.



LEADING MACHINE TOOL MANUFACTURERS USE MORSE SILENT AND ROLLER CHAINS

Abrasive Machine Tool Co.
Acme Machine Tool Co.
American Tool Works
Avery Drilling Machine Co.
Barber Coleman Machine Co.
W. F. & John Barnes Co.
Barrett Machine Tool Co.
Bradford Machine Tool Co.
Brown & Sharpe Mfg. Co.
Bryant Chucking Grinder Co.
Builders Iron Foundry
Carlton Machine Tool Co.
Cincinnati Grinders, Inc.
Cincinnati Milling Machine Co.
Cincinnati Shaper Co.
Cone Automatic Machine Co.
Consolidated Machine Tool Corp.
Davenport Machine Tool Co.

DeVlieg Machine Tool Co.
Fellows Gear Shaper Co.
Foots Burt Co.
Gisholt Machine Co.
Heald Machine Co.
Hendey Machine Co.
Ingersoll Milling Machine Co.
Jones & Lamson Machine Co.
Landis Tool Co.
Landis Machine Co.
Lodge & Shipley Machine Tool Co.
Monarch Machine Tool Co.
National Acme Co.
New Britain Gridley Machine Co.
Norton Company
Rockford Drilling Machine Co.
Rockford Machine Tool Co.
Warner & Swasey Co.

MORSE CHAIN COMPANY, ITHACA, N. Y.

DIVISION OF BORG-WARNER CORPORATION

MACHINERY, August, 1935—61

Classified Contents of this Number

DESIGN, FIXTURE AND TOOL

- Fixture for Use in Grinding Sides of Thin
Bronze Washers—*By Richard R. Holmes*..... 745
- Expanding Mandrel for Bevel Gear Blanks—
By C. J. Rayman 745
- Back Spot-Facing Tool 746

DESIGN, MACHINE

- Appearance and Utility Harmonized in Today's
Machine Design 728
- Right- and Left-Hand Thread for Converting
Rotary into Reciprocating Motion—
By Paul H. White 729
- Rotary Reversing Mechanism that Constantly
Changes its Point of Reversal—*By J. E. Fenno*.. 730
- Transforming Uniform Circular Motion into
Periodic Variable Motion—*By L. Kasper* 731
- Some Machine Tools of the Past Century..... 732
- Charts for Calculating Worm-Gear Loads—
By John H. Will 733
- A. G. M. A. Ratings for Speed Reducers 741

DIE MAKING, DIE DESIGN, AND PRESS WORK

- The Blanking and Drawing of Thin Stock..... 719
- Die-Casting with Machines of Simple Design—
By Charles O. Herb 721
- Die for Producing Bulb Section in One Operation—
By Edward Heller 743
- Die Made to Fill Rush Order for Bent, Embossed,
and Pierced Straps—*By C. W. Hinman* 744

LUBRICATION AND LUBRICANTS

- Cutting Fluids Containing Colloidal Graphite 725

MANAGEMENT PROBLEMS

- A Cutter Cupboard without Lost Space—
By Oliver Herbert 720
- Sound Castings are the Result of Teamwork 728
- A Matter of Implied Guarantees—*By Leo T. Parker* 742

- The Fallacy of Wage and Hour Controls 774

- Making Use of the Back of the Shipping Tag ... 774

MATERIALS, METALS, AND ALLOYS

- Monel Metal Containing Aluminum is Non-
Magnetic 750
- Nickel-Alloy Cast Iron Gives Long Die Life 750
- Rubber Lining Protects Tanks from Corrosive
Liquids 750
- Brass and Bronze Alloys that Can be Welded 750
- Free-Cutting Aluminum Alloys for Screw
Machine Work 751
- A Durez Material for the Cases of Office Machines 751
- How Much Nickel is There in a Nickel? 751

NEWS OF INDUSTRY

- Engineering News Flashes 726
- A. H. Tuechter Completes Fifty Years with the
Cincinnati Bickford Tool Co. 747
- Giant Steel Mill Roller Bearing 752
- New Type Dynamometer 752
- Bicycle Industry is Still a Big Business 754
- Remarkable Service Records 774
- News of the Industry 775

SHOP PRACTICE

- Unusual Jobs on Keller Machines—
By Charles O. Herb 713
- Use of Haynes Stellite J-Metal for Machining
Lycoming Motors 748
- Precision Band Saw on Die Work 752
- Shop Equipment News 755
- Cutting External Threads on a High-Speed
Tapper 774

WELDING AND CUTTING PRACTICE

- Correcting Errors in Assembled Parts with an
Oxy-Acetylene Cutting Machine 746

MACHINERY'S DATA SHEETS 281 and 282

THE A-B-C OF STAINLESS STEEL—3

Compiled by The Carpenter Steel Co., Reading, Pa.

| Group A | Group B | Group C |
|---|---|--|
| Analysis Groups A and B are primarily straight chromium steels. Multiply the per cent of carbon in the steel by 17. Subtract this from the per cent of chromium in the steel. If the result is less than 12.5 per cent, the steel belongs to Group A; if greater than 12.5 per cent, it belongs to Group B. Either group may contain small percentages of copper, nickel, silicon, molybdenum, sulphur, etc., for special purposes. | | Contains at least 24 per cent of chromium and nickel combined. Neither chromium nor nickel should be less than 8 per cent. May contain small percentages of other elements for special purposes. |
| Welding Can be welded with gas, electric arc, or resistance. Weld air-hardens. No grain growth. | Can be welded with gas, electric arc, or resistance. Grain growth and brittleness may result. | Easiest group to weld. Welds are tough. Corrosion resistance may be badly damaged by welding. |
| Corrosion Resistance Very satisfactory for resisting weather, water, and some chemicals. | Better than Group A. | Better than Group B having equal chromium content. |
| Intergranular Corrosion No. | No. | Yes. |
| Scale Resistance Recommended for continuous service up to 1200 degrees F. | Better than Group A. Useful temperature range for this steel increases with the percentage of chromium. | Better than steels of equal chromium in Group B. |
| Strength at High Temperatures Has better strength than carbon steel up to 1200 degrees F. | Better than Group A. | Best steels available are of this group. |

MACHINERY'S Data Sheet No. 281, New Series, September, 1934

HARDNESS NUMBERS OBTAINED BY DIFFERENT TESTS*

| Brinell | Firth Hardometer | Rockwell | | Sclero-scope | Brinell | Firth Hardometer | Rockwell | | Sclero-scope |
|---------|------------------|----------------------|---------|--------------|---------|------------------|----------------------|---------|--------------|
| | | 10 mm. Ball 3000 Kg. | 120 Kg. | | | | 10 mm. Ball 3000 Kg. | 120 Kg. | |
| 800 | 1220 | 71 | 70 | 100 | 276 | 278 | 105 | 104 | 42 |
| 780 | 1170 | 68 | 67 | 99 | 261 | 272 | 103 | 103 | 41 |
| 760 | 1114 | 66 | 65 | 98 | 258 | 261 | 102 | 102 | 40 |
| 745 | 1060 | 64 | 63 | 97 | 255 | 255 | 101 | 101 | 39 |
| 725 | 1021 | 62 | 61 | 96 | 249 | 250 | 100 | 100 | 38 |
| 712 | 940 | 60 | 59 | 95 | 245 | 246 | 99 | 99 | 37 |
| 682 | 905 | 58 | 57 | 94 | 240 | 240 | 98 | 98 | 36 |
| 668 | 867 | 56 | 55 | 93 | 237 | 235 | 97 | 97 | 35 |
| 652 | 833 | 54 | 53 | 92 | 232 | 232 | 96 | 96 | 34 |
| 636 | 803 | 52 | 51 | 91 | 224 | 221 | 95 | 95 | 33 |
| 614 | 775 | 50 | 49 | 90 | 217 | 217 | 94 | 94 | 32 |
| 601 | 746 | 48 | 47 | 89 | 211 | 213 | 93 | 93 | 31 |
| 590 | 727 | 46 | 45 | 88 | 206 | 209 | 92 | 92 | 30 |
| 576 | 694 | 44 | 43 | 87 | 203 | 201 | 91 | 91 | 29 |
| 552 | 649 | 42 | 41 | 86 | 199 | 199 | 90 | 90 | 28 |
| 545 | 639 | 40 | 39 | 85 | 197 | 197 | 89 | 89 | 27 |
| 529 | 606 | 38 | 37 | 84 | 196 | 196 | 88 | 88 | 27 |
| 514 | 587 | 36 | 35 | 83 | 191 | 190 | 87 | 87 | 27 |
| 502 | 565 | 34 | 33 | 82 | 187 | 186 | 86 | 86 | 26 |
| 495 | 551 | 32 | 31 | 81 | 185 | 184 | 85 | 85 | 26 |
| 477 | 534 | 30 | 29 | 80 | 183 | 183 | 84 | 84 | 25 |
| 461 | 503 | 28 | 27 | 79 | 180 | 177 | 83 | 83 | 25 |
| 451 | 489 | 26 | 25 | 78 | 175 | 174 | 82 | 82 | 25 |
| 444 | 474 | 24 | 23 | 77 | 170 | 171 | 81 | 81 | 24 |
| 427 | 460 | 22 | 21 | 76 | 167 | 168 | 80 | 80 | 24 |
| 415 | 435 | 20 | 19 | 75 | 165 | 165 | 79 | 79 | 23 |
| 401 | 423 | 18 | 17 | 74 | 163 | 162 | 78 | 78 | 23 |
| 393 | 401 | 16 | 15 | 73 | 160 | 159 | 77 | 77 | 22 |
| 375 | 390 | 14 | 13 | 72 | 156 | 154 | 76 | 76 | 22 |
| 370 | 385 | 12 | 11 | 71 | 154 | 152 | 75 | 75 | 22 |
| 362 | 380 | 10 | 9 | 70 | 152 | 150 | 74 | 74 | 21 |
| 351 | 361 | 8 | 7 | 69 | 150 | 149 | 73 | 73 | 21 |
| 346 | 346 | 6 | 5 | 68 | 147 | 147 | 72 | 72 | 21 |
| 341 | 341 | 4 | 3 | 67 | 145 | 144 | 71 | 71 | 20 |
| 331 | 331 | 2 | 1 | 66 | 143 | 142 | 70 | 70 | 20 |
| 323 | 323 | 1 | 0 | 65 | 141 | 141 | 69 | 69 | 19 |
| 311 | 311 | 0 | 0 | 64 | 140 | 140 | 68 | 68 | 19 |
| 301 | 301 | 0 | 0 | 63 | 135 | 135 | 67 | 67 | 18 |
| 293 | 293 | 0 | 0 | 62 | 130 | 130 | 66 | 66 | 18 |
| 285 | 285 | 0 | 0 | 61 | 120 | 120 | 65 | 65 | 17 |

*These conversion or equivalent hardness numbers are approximate only, because of variations in methods of testing hardness with different types of equipment.

MACHINERY'S Data Sheet No. 282, New Series, September, 1934

Based on a Compilation by the Firth-Sterling Steel Co.

MACHINE TYPE DATA SHEET

THE DATA SHEET
OF THE MACHINE

| | |
|------------------------|--|
| 1. NAME OF THE MACHINE | |
| 2. TYPE OF MACHINE | |
| 3. MANUFACTURER | |
| 4. MODEL | |
| 5. SERIAL NUMBER | |
| 6. DATE OF PURCHASE | |
| 7. DATE OF INSPECTION | |
| 8. INSPECTOR | |
| 9. COMMENTS | |
| 10. SIGNATURE | |
| 11. DATE | |
| 12. LOCATION | |
| 13. OTHER INFORMATION | |
| 14. REMARKS | |
| 15. APPROVAL | |
| 16. REVISION | |
| 17. STATUS | |
| 18. HISTORY | |
| 19. MAINTENANCE | |
| 20. INSPECTION | |
| 21. REPAIRS | |
| 22. UPGRADES | |
| 23. DECOMMISSIONING | |
| 24. DISPOSAL | |
| 25. OTHER | |

REVISION 1.0 - 10/1/2000

MACHINERY'S DATA SHEETS 283 and 284

TOOL AND CUTTER MATERIALS—1

In the table, a plain carbon tool steel is given thus: Carbon, 1.10-1.20. An alloy tool steel is designated thus: Chromium, 0.40-0.50; carbon, 0.80-1.00. The steel referred to as "Low tungsten" contains approximately 1.66 per cent tungsten, 1.42 per cent chro-

mium, 0.27 per cent vanadium and 0.43 per cent carbon. The standard 18-4-1 high-speed steel (18 per cent tungsten, 4 per cent chromium, 1 per cent vanadium, with 0.60 to 0.75 per cent carbon) is referred to as "High speed 18-4-1."

| Type of Tool | Material (All Figures Indicate Percentages) | Type of Tool | Material (All Figures Indicate Percentages) |
|-----------------------|---|----------------------------------|--|
| Arbors | (1) Carbon, 1.10-1.20 (2) Chromium, 0.40-0.50; carbon, 0.80-1.00 | Chisels, hand | (1) Carbon, 0.80-0.90 (2) Vanadium, 0.15-0.40; carbon, 0.75-1.20 |
| Augers, hand power | (1) Carbon, 0.80-0.90 (1) Chromium, 0.08; molybdenum, 0.28; carbon, 0.96 | Pneumatic, stone and concrete | (1) Carbon, 0.80-0.90 (2) Low tungsten |
| Beading tools | (1) Carbon, 0.80-0.90 (2) Vanadium, 0.20; molybdenum, 0.40; carbon, 0.55 | Collets | (1) Carbon, 0.95-1.05 |
| Blacksmith's tools | (1) Carbon, 0.70-0.80 (2) Vanadium, 0.20; molybdenum, 0.40; carbon, 0.55 | Counterbores | (1) Carbon, 1.10-1.25 (1) Carbon, 1.20-1.30 |
| Boring tools | (1) Carbon 1.10-1.25 (2) High speed 18-4-1 (3) Cobalt, 5-8-12; tungsten, 14; chromium, 4; vanadium, 2 (4) Stellite and cemented tungsten carbide for cast iron, bronze, and aluminum alloys (5) Cemented tantalum carbide for steel and Monel metal | Cutters, brass | (2) Tungsten, 0.75-0.95; chromium, 0.10-0.20; carbon, 0.80-1.25 (See Milling Cutters) |
| Boring-bars | (1) Carbon, 0.50-0.60 | Milling Pipe | (1) Vanadium, 0.15-0.40; carbon, 0.75-1.20 |
| Breakers, concrete | (1) Low tungsten | Cut-off tools | (1) Carbon, 1.10-1.25 (2) High speed 18-4-1 (3) Cobalt, 5-8-12; tungsten, 14; chromium, 4; vanadium, 2 |
| Broaches | (1) High speed 18-4-1 (2) Tungsten, 14; chromium, 4; vanadium, 2 | Dies, automobile body | (1) Chromium, 11-12; vanadium, 0.20-0.25; molybdenum, 0.70-0.80; carbon, 1.5 |
| Calking tools | (1) Carbon, 0.80-0.90 | Bending and forming, cold | (1) Carbon, 0.95-1.05 (2) Chromium, 12.5; vanadium, 0.60-0.70; carbon, 1.0-1.2 |
| Center-punches | (1) Carbon, 0.80-0.90 | Blanking | (1) Carbon, 0.95-1.05 (2) Chromium, 12.5; vanadium, 0.60-0.70; carbon, 1.0-1.2 |
| Chasers | (1) High speed 18-4-1 (2) Chromium, 0.40-0.50; carbon, 0.80-1.00 | Coin press | (3) Tungsten, 0.75-0.95; chromium, 0.10-0.20; carbon, 0.80-1.25 (1) Chromium, 0.40-0.50; carbon, 0.80-1.0 |

MACHINERY'S Data Sheet No. 283, New Series, October, 1934

Compiled by Charles H. Hughes

TOOL AND CUTTER MATERIALS—2

In the table, a plain carbon tool steel is given thus: Carbon, 1.10-1.20. An alloy tool steel is designated thus: Chromium, 0.40-0.50; carbon, 0.80-1.00. The steel referred to as "Low tungsten" contains approximately 1.66 per cent tungsten, 1.42 per cent chro-

mium, 0.27 per cent vanadium and 0.43 per cent carbon. The standard 18-4-1 high-speed steel (18 per cent tungsten, 4 per cent chromium, 1 per cent vanadium, with 0.60 to 0.75 per cent carbon) is referred to as "High speed 18-4-1."

| Type of Tool | Material (All Figures Indicate Percentages) | Type of Tool | Material (All Figures Indicate Percentages) |
|--|---|------------------------------|--|
| Dies, cutting, paper, leather, etc. | (1) Tungsten, 0.40-0.60; chromium, 0.40-0.60; carbon, 0.85-0.95 | Drills, wood | (1) Carbon, 1.2-1.3 (2) Chromium, 0.40-0.50; carbon, 0.80-1.0 |
| Die-casting | (1) Vanadium, 0.15-0.40; carbon, 0.75-1.2 (2) Tungsten, 8.0-14.0; chromium, 1.0-3.0; vanadium, 0.20-1.00; carbon, 0.30-0.50 | Concrete and stone | (1) Carbon, 1.1-1.2 (2) Vanadium, 0.15-0.40; carbon, 0.75-1.2 (3) Low tungsten |
| Drawing, for copper and brass | (1) Tungsten, 3.5-4.00; chromium, 0.10-0.20; vanadium, 0.20-0.35; carbon, 1.35 | Engraver's tools | (1) Tungsten, 3.4; chromium, 1.0; vanadium, 0.2 |
| Drawing, deep | (1) Carbon, 1.15-1.25.—(2) Chromium, 0.40-0.50; carbon, 0.80-1.0.—(3) Vanadium, 0.15-0.40; carbon, 0.75-1.2 | Gages, plug, ring, thread | (1) Manganese, 1.0-1.70; carbon, 0.80-1.10 |
| Embossing | (1) Carbon, 1.0-1.10 | Hammers, black- smith's | (1) Carbon, 0.80-0.90 |
| Extrusion | (1) Vanadium, 0.15-0.40; carbon, 0.75-1.2 | Pneumatic | (1) Low tungsten |
| Heading, cold | (1) Carbon, 0.90-1.00.—(2) Vanadium, 0.15-0.40; carbon, 0.75-1.20 | Hobs | (1) Carbon, 1.0-1.1 (2) High speed 18-4-1 |
| Jewelers | (1) Vanadium, 0.15-0.40; carbon, 0.75-1.20 | Knives, pocket | (1) Carbon, 0.90-1.0 |
| Riveting | (1) Carbon, 0.90-1.0.—(2) Chromium, 0.40-0.50; carbon, 0.80-1.00.—(3) Vanadium, 0.15-0.40; carbon, 0.75-1.2 | Stainless steel | (1) Chromium, 12-18; carbon, 0.30-0.80 |
| Drills, metal | (1) Carbon tool steel for sizes 1/4 to 3/8 inch; 0.80-0.90 carbon (2) For sizes above 3/8 inch, use alloy tool steel: Chromium, 0.40-0.50; carbon, 0.80-1.00; or high speed 18-4-1 | Wood-working | (1) Carbon, 1.0-1.09 (2) Tungsten, 12.5; chromium, 3; molybdenum, 1; vanadium, 0.15; carbon, 1.20 |
| | | Knurling tools | (1) Manganese, 1.0; molybdenum, 0.40; vanadium, 0.20; carbon, 0.55 (See Boring tools) |
| | | Lathe tools | (1) Carbon, 1.0-1.3 |
| | | Letter stamps, hand | |

MACHINERY'S Data Sheet No. 284, New Series, October, 1934

Compiled by Charles H. Hughes

MACHINERY, October, 1934—88-A

DATE: 10/10/83

TIME: 10:00 AM

LOCATION: 1000

DESCRIPTION: 1000

REMARKS: 1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

1000

MACHINERY'S DATA SHEETS 285 and 286

TOOL AND CUTTER MATERIALS—3

In the table, a plain carbon tool steel is given thus: Carbon, 1.10-1.20. An alloy tool steel is designated thus: Chromium, 0.40-0.50; carbon, 0.80-1.00. The steel referred to as "Low tungsten" contains approximately 1.66 per cent tungsten, 1.42 per cent chro-

mium, 0.27 per cent vanadium and 0.43 per cent carbon. The standard 18-4-1 high-speed steel (18 per cent tungsten, 4 per cent chromium, 1 per cent vanadium, with 0.60 to 0.75 per cent carbon) is referred to as "High speed 18-4-1."

| Type of Tool | Material (All Figures Indicate Percentages) | Type of Tool | Material (All Figures Indicate Percentages) |
|--------------------------|---|------------------------------------|--|
| Mandrels | (1) Carbon, 0.90-1.10 (2) Chromium, 0.40-0.50; carbon, 0.80-1.0 | Rivet buster | (1) Vanadium, 0.20; molybdenum, 0.40; carbon, 0.55 |
| Milling cutters, solid | (1) Carbon, 1.10-1.2 for infrequent use or for brass and aluminum (2) High speed 18-4-1 | Rivet sets | (1) Carbon, 0.60-0.70 (2) Vanadium, 0.15-0.40; carbon, 0.75 (3) Vanadium, 0.20; molybdenum, 0.40; carbon, 0.55 |
| Inserted-blade | (1) High speed 18-4-1 (2) Cobalt 5-8-12; tungsten, 14; chromium, 4; vanadium, 2 (3) Stellite (4) Cemented tungsten carbide for cast iron, bronze, or similar free-cutting abrasive material (5) Cemented tantalum carbide for steel, Monel metal (See Boring tools) | Saws, circular Inserted cutters | (1) Carbon, 1.0-1.2 (1) High speed 18-4-1 (2) Stellite (3) Cemented tungsten carbide for cast iron, Bakelite and other plastics; and tantalum carbide for steel |
| Planer tools, metal | (1) Carbon, 1.2-1.3 (2) High speed 18-4-1 | Screwdrivers | (1) Carbon, 0.60-0.70 |
| Wood | (1) Cemented tungsten carbide (1) Carbon, 0.70-0.80 (2) Chromium, 0.90-1.00; vanadium, 0.16-0.20; carbon, 0.70-0.80 (3) Low tungsten | Shear blades or knives | (1) Carbon, 0.80-0.90 (2) Vanadium, 0.15-0.40; carbon, 0.75-1.20 (3) Chromium, 0.90-1.0; vanadium, 0.16-0.20; carbon, 0.70-0.80 |
| Plywood | | Slicers, meat | (1) Carbon, 1.0-1.2 (See Reamers) |
| Pneumatic tools | | Taps | (1) Carbon, 1.0-1.04 (for fine threads) |
| Punches, cold work, hand | (1) Carbon, 0.85-0.90 (1) Vanadium, 0.15-0.40; carbon, 0.75-1.2 | Thread-rolling dies | (1) High speed 18-4-1 (for ordinary threads) |
| Machine | (1) Tungsten, 9; chromium, 2.8; vanadium, 0.3; carbon, 0.40 | Wedges, wood splitting | (1) Carbon, 0.85-0.95 (2) Chromium, 0.40-0.50; carbon, 0.80-1.0 |
| Hot work | (1) Carbon, 1.10-1.25 (2) High speed 18-4-1 | Stone | (1) Carbon, 0.80-0.85 |
| Reamers | | | |

MACHINERY'S Data Sheet No. 285, New Series, November, 1934

Compiled by Charles H. Hughes

DEFLECTION OF SHAFTING SUPPORTED FREELY AT EACH END

| Diam. of Shaft, Inches | Distance Between Supports, Feet | | | | | | | | | | | | |
|------------------------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|-------|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| | Deflection in Inches* | | | | | | | | | | | | |
| 15/16 | 0.0038 | 0.012 | 0.029 | 0.060 | 0.112 | 0.193 | 0.292 | 0.465 | 0.684 | 0.964 | 1.328 | ..... | ..... |
| 1 3/16 | 0.0023 | 0.0075 | 0.018 | 0.037 | 0.070 | 0.101 | 0.191 | 0.291 | 0.429 | 0.604 | 0.832 | 1.119 | ..... |
| 1 7/16 | 0.0016 | 0.0051 | 0.012 | 0.026 | 0.048 | 0.082 | 0.131 | 0.199 | 0.293 | 0.413 | 0.568 | 0.764 | 1.076 |
| 1 11/16 | | 0.0036 | 0.0090 | 0.019 | 0.035 | 0.059 | 0.095 | 0.120 | 0.212 | 0.299 | 0.412 | 0.554 | 0.730 |
| 1 15/16 | | 0.0023 | 0.0068 | 0.014 | 0.026 | 0.045 | 0.072 | 0.110 | 0.162 | 0.228 | 0.314 | 0.423 | 0.556 |
| 2 3/16 | | 0.0022 | 0.0055 | 0.011 | 0.021 | 0.035 | 0.056 | 0.086 | 0.127 | 0.178 | 0.246 | 0.331 | 0.436 |
| 2 7/16 | | 0.0018 | 0.0043 | 0.0091 | 0.017 | 0.028 | 0.045 | 0.069 | 0.101 | 0.143 | 0.197 | 0.265 | 0.349 |
| 2 11/16 | | | 0.0035 | 0.0074 | 0.014 | 0.023 | 0.037 | 0.055 | 0.083 | 0.117 | 0.162 | 0.218 | 0.290 |
| 2 15/16 | | | 0.0030 | 0.0061 | 0.011 | 0.019 | 0.031 | 0.048 | 0.070 | 0.098 | 0.136 | 0.182 | 0.240 |
| 3 3/16 | | | 0.0025 | 0.0052 | 0.0089 | 0.017 | 0.026 | 0.041 | 0.059 | 0.083 | 0.115 | 0.155 | 0.204 |
| 3 7/16 | | | 0.0022 | 0.0045 | 0.0084 | 0.014 | 0.023 | 0.035 | 0.051 | 0.072 | 0.100 | 0.134 | 0.177 |
| 3 11/16 | | | 0.0019 | 0.0039 | 0.0072 | 0.012 | 0.020 | 0.030 | 0.044 | 0.062 | 0.086 | 0.116 | 0.152 |
| 3 15/16 | | | 0.0016 | 0.0034 | 0.0061 | 0.011 | 0.017 | 0.026 | 0.039 | 0.055 | 0.075 | 0.101 | 0.134 |
| 4 7/16 | | | | 0.0027 | 0.0050 | 0.0085 | 0.014 | 0.021 | 0.031 | 0.043 | 0.059 | 0.080 | 0.108 |
| 4 15/16 | | | | 0.0022 | 0.0040 | 0.0069 | 0.011 | 0.017 | 0.025 | 0.035 | 0.048 | 0.064 | 0.085 |
| 5 7/16 | | | | 0.0018 | 0.0033 | 0.0057 | 0.0091 | 0.014 | 0.020 | 0.029 | 0.039 | 0.053 | 0.070 |
| 5 15/16 | | | | | 0.0023 | 0.0048 | 0.0078 | 0.012 | 0.017 | 0.024 | 0.033 | 0.045 | 0.059 |
| 6 7/16 | | | | | 0.0024 | 0.0041 | 0.0065 | 0.0099 | 0.015 | 0.021 | 0.027 | 0.038 | 0.050 |
| 6 15/16 | | | | | 0.0020 | 0.0035 | 0.0056 | 0.0085 | 0.013 | 0.017 | 0.024 | 0.033 | 0.043 |
| 7 7/16 | | | | | 0.0017 | 0.0030 | 0.0048 | 0.0074 | 0.011 | 0.015 | 0.021 | 0.028 | 0.037 |
| 7 15/16 | | | | | | 0.0026 | 0.0042 | 0.0065 | 0.0095 | 0.013 | 0.018 | 0.025 | 0.033 |
| 8 1/2 | | | | | | 0.0023 | 0.0037 | 0.0056 | 0.0083 | 0.012 | 0.016 | 0.022 | 0.029 |
| 9 | | | | | | 0.0021 | 0.0033 | 0.0050 | 0.0074 | 0.010 | 0.015 | 0.019 | 0.026 |
| 9 1/2 | | | | | | 0.0019 | 0.0029 | 0.0045 | 0.0066 | 0.0094 | 0.013 | 0.017 | 0.023 |
| 10 | | | | | | 0.0017 | 0.0026 | 0.0041 | 0.0060 | 0.0085 | 0.012 | 0.016 | 0.021 |

*For unloaded shafts, the distance between supports should be such that the deflection is not over 0.010 inch per foot.

Thus the table shows, for example, that a 15/16-inch shaft may have the supports 6 feet apart.

MACHINERY'S Data Sheet No. 286, New Series, November, 1934

Contributed by C. E. Bailey

MACHINERY, November, 1934—144-A

MACHINERY'S DATA SHEETS 255 and 256

1901 AND CUTTER & TOWERS

| MACHINERY'S DATA SHEET 255 | |
|----------------------------|--|
| 1. Name of Machine | |
| 2. Make | |
| 3. Year | |
| 4. Description of Machine | |
| 5. Location | |
| 6. Operator | |
| 7. Date | |
| 8. Remarks | |
| 9. Signature | |
| 10. Initials | |
| 11. Date | |
| 12. Remarks | |
| 13. Signature | |
| 14. Initials | |
| 15. Date | |
| 16. Remarks | |
| 17. Signature | |
| 18. Initials | |
| 19. Date | |
| 20. Remarks | |
| 21. Signature | |
| 22. Initials | |
| 23. Date | |
| 24. Remarks | |
| 25. Signature | |
| 26. Initials | |
| 27. Date | |
| 28. Remarks | |
| 29. Signature | |
| 30. Initials | |
| 31. Date | |
| 32. Remarks | |
| 33. Signature | |
| 34. Initials | |
| 35. Date | |
| 36. Remarks | |
| 37. Signature | |
| 38. Initials | |
| 39. Date | |
| 40. Remarks | |
| 41. Signature | |
| 42. Initials | |
| 43. Date | |
| 44. Remarks | |
| 45. Signature | |
| 46. Initials | |
| 47. Date | |
| 48. Remarks | |
| 49. Signature | |
| 50. Initials | |
| 51. Date | |
| 52. Remarks | |
| 53. Signature | |
| 54. Initials | |
| 55. Date | |
| 56. Remarks | |
| 57. Signature | |
| 58. Initials | |
| 59. Date | |
| 60. Remarks | |
| 61. Signature | |
| 62. Initials | |
| 63. Date | |
| 64. Remarks | |
| 65. Signature | |
| 66. Initials | |
| 67. Date | |
| 68. Remarks | |
| 69. Signature | |
| 70. Initials | |
| 71. Date | |
| 72. Remarks | |
| 73. Signature | |
| 74. Initials | |
| 75. Date | |
| 76. Remarks | |
| 77. Signature | |
| 78. Initials | |
| 79. Date | |
| 80. Remarks | |
| 81. Signature | |
| 82. Initials | |
| 83. Date | |
| 84. Remarks | |
| 85. Signature | |
| 86. Initials | |
| 87. Date | |
| 88. Remarks | |
| 89. Signature | |
| 90. Initials | |
| 91. Date | |
| 92. Remarks | |
| 93. Signature | |
| 94. Initials | |
| 95. Date | |
| 96. Remarks | |
| 97. Signature | |
| 98. Initials | |
| 99. Date | |
| 100. Remarks | |

REVISIONS OF DATA SHEET 255 AND 256

| REVISIONS OF DATA SHEET 255 AND 256 | |
|-------------------------------------|--|
| 1. Name of Machine | |
| 2. Make | |
| 3. Year | |
| 4. Description of Machine | |
| 5. Location | |
| 6. Operator | |
| 7. Date | |
| 8. Remarks | |
| 9. Signature | |
| 10. Initials | |
| 11. Date | |
| 12. Remarks | |
| 13. Signature | |
| 14. Initials | |
| 15. Date | |
| 16. Remarks | |
| 17. Signature | |
| 18. Initials | |
| 19. Date | |
| 20. Remarks | |
| 21. Signature | |
| 22. Initials | |
| 23. Date | |
| 24. Remarks | |
| 25. Signature | |
| 26. Initials | |
| 27. Date | |
| 28. Remarks | |
| 29. Signature | |
| 30. Initials | |
| 31. Date | |
| 32. Remarks | |
| 33. Signature | |
| 34. Initials | |
| 35. Date | |
| 36. Remarks | |
| 37. Signature | |
| 38. Initials | |
| 39. Date | |
| 40. Remarks | |
| 41. Signature | |
| 42. Initials | |
| 43. Date | |
| 44. Remarks | |
| 45. Signature | |
| 46. Initials | |
| 47. Date | |
| 48. Remarks | |
| 49. Signature | |
| 50. Initials | |
| 51. Date | |
| 52. Remarks | |
| 53. Signature | |
| 54. Initials | |
| 55. Date | |
| 56. Remarks | |
| 57. Signature | |
| 58. Initials | |
| 59. Date | |
| 60. Remarks | |
| 61. Signature | |
| 62. Initials | |
| 63. Date | |
| 64. Remarks | |
| 65. Signature | |
| 66. Initials | |
| 67. Date | |
| 68. Remarks | |
| 69. Signature | |
| 70. Initials | |
| 71. Date | |
| 72. Remarks | |
| 73. Signature | |
| 74. Initials | |
| 75. Date | |
| 76. Remarks | |
| 77. Signature | |
| 78. Initials | |
| 79. Date | |
| 80. Remarks | |
| 81. Signature | |
| 82. Initials | |
| 83. Date | |
| 84. Remarks | |
| 85. Signature | |
| 86. Initials | |
| 87. Date | |
| 88. Remarks | |
| 89. Signature | |
| 90. Initials | |
| 91. Date | |
| 92. Remarks | |
| 93. Signature | |
| 94. Initials | |
| 95. Date | |
| 96. Remarks | |
| 97. Signature | |
| 98. Initials | |
| 99. Date | |
| 100. Remarks | |

REVISIONS OF DATA SHEET 255 AND 256

MACHINERY'S DATA SHEETS 287 and 288

PHYSICAL PROPERTIES AND APPLICATIONS OF HARD-FACING MATERIALS—1

| Hard-Facing Material | Hascrome | Haynes Stellite | Haystellite |
|--|---|---|---|
| Composition or Classification Identifying Material | Self-hardening, chromium-manganese-iron alloy | Non-ferrous alloy of cobalt, chromium, and tungsten | Cast tungsten carbide approaching the diamond in hardness |
| Grades and Forms in which Material is Obtainable | Coated and uncoated welding rod, 1/4 and 3/16 inch in diameter, and special castings such as tips for worn dipper teeth | Three grades of welding rod. Sizes range from 1/8 to 3/8 inch in diameter. Also available in various grades in the form of tool bits, bar stock, castings, and bushings. | Sixteen different types of "Composite Rod" consisting of various screen sizes of sharp, irregular shaped grains of Haystellite uniformly distributed in a binding material such as Haynes Stellite, Hascrome or High Test Steel. (Haystellite is also made in small castings for "hard-setting.") |
| Purpose for which Material is Generally Used and Outstanding Qualities | Primarily for hard-facing of parts subject to severe impact and only moderate abrasive wear and for building up badly worn parts to nearly original size preparatory to application of more expensive hard-facing material, such as Haynes Stellite or Haystellite Composite Rod. Also used for tacking cast inserts of Haystellite in place and for binder in Haystellite Composite Rod. | Generally known as the standard hard-facing, wear-resistant alloy. Grade No. 1 welding rod has been developed specifically as abrasion resistant hard-facing material and should not be confused with the Haynes Stellite tool material; it is not recommended for metal-cutting tools. Grade 12 rod is for coating fairly large surfaces, and is less wear-resistant but stronger than No. 1. No. 6 rod is recommended for coating surfaces subject to shock or impact and wherever a keen cutting edge is necessary, as for hot shearing and blanking dies. All three grades cannot be filed or machined, but can be easily finished by grinding. All have quality of red hardness, take a high polish, and have a low coefficient of friction. | Haystellite Composite Rod is used where the utmost in resistance to abrasion is desired. The list of standard rods includes practically every screen size of Haystellite and type of binding material required for facing oil-well drilling tools and other applications involving similar abrasion resistance problems. (Haystellite inserts in the form of small castings which cannot be applied in the same manner as Composite Rod, but by a process termed "hard-setting," give a surface having greater resistance to wear than any other combination of hard-facing materials.) |

MACHINERY'S Data Sheet No. 287, New Series, December, 1934

Based on data furnished by the Haynes Stellite Co.

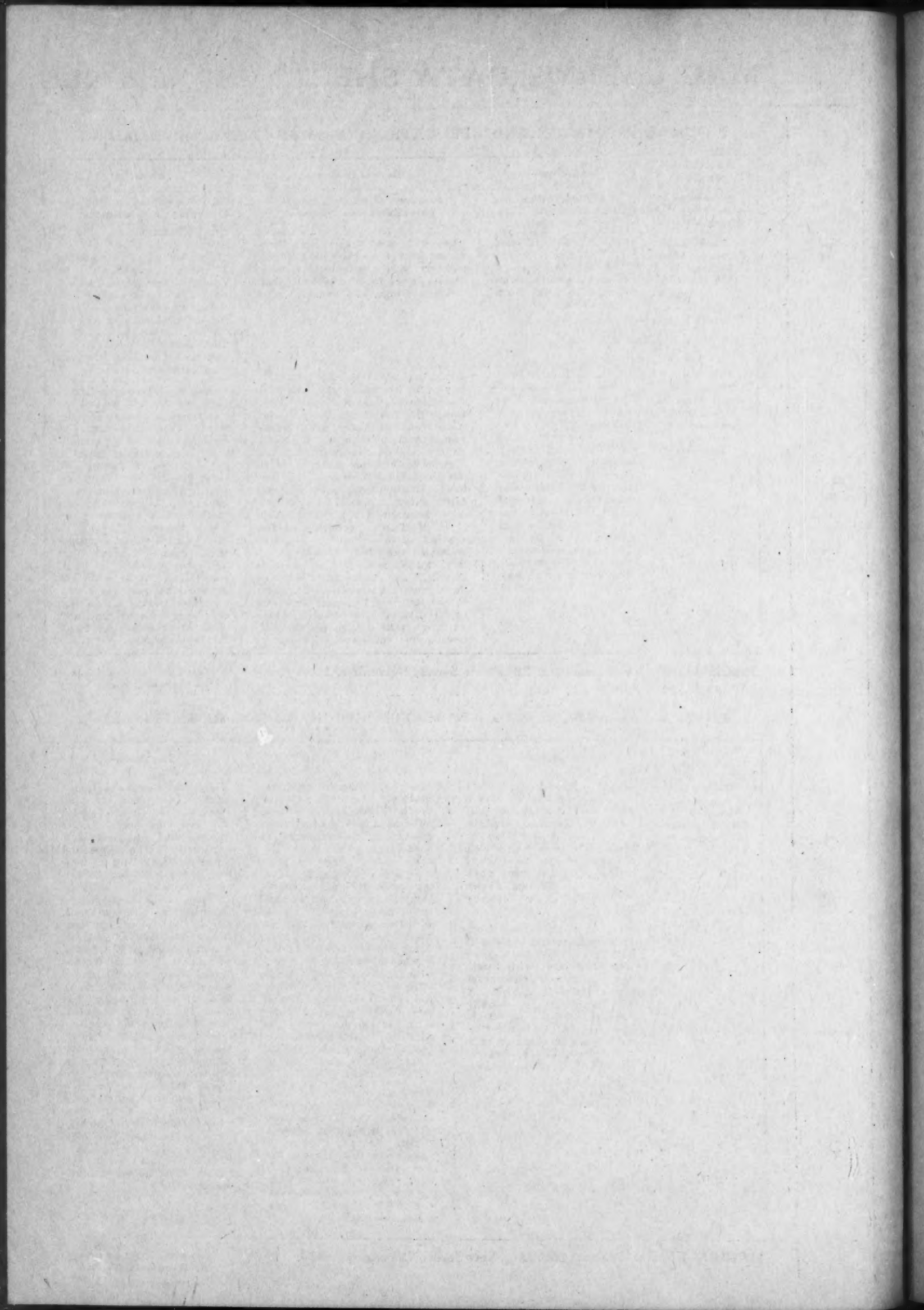
PHYSICAL PROPERTIES AND APPLICATIONS OF HARD-FACING MATERIALS—2

| Hard-Facing Material | Hascrome | Haynes Stellite | Haystellite |
|---|---|--|--|
| Method of Applying Materials by Oxy-Acetylene Process | <p>When applying on steel, clean surface and use flux if surface cannot be fully cleaned. Use flame containing excess of acetylene adjusted half way between neutral and carbonizing flame. Apply Hascrome when steel surface is just "sweating"—puddling is unnecessary.</p> <p>When applying on cast iron, clean surface and preheat if necessary. Then heat small area at a time with torch, breaking the surface crust with the end of the rod. A little puddling is usually necessary and a good flux is often helpful. Care must be taken when working on thin surfaces, edges, or corners.</p> | <p>When applying on steel, remove all rust, scale, or other foreign substances from area to be hard-faced by grinding, machining, or chipping. If preheating is necessary, use oxy-acetylene flame or furnace. In applying hard-facing material, use oxy-acetylene flame adjusted so that outer cone denoting excess acetylene extends double the length of the inner cone. Bring a small section of the surface to sweating condition with blow-pipe and then bring end of rod into flame and allow it to melt and spread over "sweating" area. Hardened steels should be annealed before hard-facing, and if necessary, they can be rehardened by quenching in oil—not water.</p> <p>When hard-facing cast iron the metal will not "sweat" like steel and a little less acetylene is required. Haynes Stellite does not flow as readily on cast iron as on steel, and it is necessary to break the surface crust with the end of the rod. A cast-iron welding flux is sometimes necessary.</p> | Haystellite Composite Rod is applied with the oxy-acetylene flame the same as rods of Hascrome and Haynes Stellite, with small excess of acetylene in the flame and without penetrating as deeply into the metal being faced as in ordinary steel welding. Composite Rod does not flow as freely as ordinary rods, due to the Haystellite particles which are not melted. A certain amount of stirring with the rod is necessary to obtain even distribution of deposited metal. The metal on which hard-facing has been applied can be heat-treated to increase hardness or toughness without detrimental effect on the hard-facing layer by quenching in oil, not water. (Haystellite inserts cast to required shape are hard set in steel by melting a small area around insert and submerging approximately one-third of the insert in the molten puddle. A thin coating of rod is then flowed around the insert.) |

MACHINERY'S Data Sheet No. 288, New Series, December, 1934

Based on data furnished by the Haynes Stellite Co.

MACHINERY, December, 1934—208-A



MACHINERY'S DATA SHEETS 289 and 290

PHYSICAL PROPERTIES AND APPLICATIONS OF HARD-FACING MATERIALS—3

| Hard-Facing Material | Hascrome | Haynes Stellite | Haystellite |
|---|--|--|---|
| Method of Applying Material by Metallic Arc Process | Reversed polarity must be used, making the rod the positive electrode. A current of 200 to 250 amperes is required for 1/4-inch rod. The 3/16-inch diameter rod is recommended for arc welding, and flows well at 150 to 175 amperes and 18 to 20 volts. Flows better with flux coating. Flux may be carbide sludge mixed with borax, but a better flux is one ounce each of sodium bicarbonate, calcium carbonate, shellac, and borax glass with alcohol to thin to proper consistency. | The metallic arc process is generally used for coating large surfaces and for parts subject to trouble from warp-age. The polarity should be reversed, making the rod the positive electrode. The 1/4-inch rod requires 175 to 200 amperes, and the 5/16-inch rod 225 to 250 amperes. Bare rods can be used, but best results are obtained with a good coating, such as a mixture of equal parts of calcium carbonate, silica flour, and either borax glass or sodium bicarbonate, mixed with shellac. | For depositing Composite Rod by the metallic arc, use reversed polarity, making the rod the positive electrode. A current of 225 to 275 amperes, depending on the type of rod, is recommended with an open circuit voltage of about 70 volts. |
| Hardness and Strength of Deposited Material | Small excess of acetylene flame with slow cooling gives Brinell hardness of 250 to 300, and when quenched, 240 to 290. Heavy excess of acetylene with slow cooling gives Brinell hardness of 450 to 500, and when quenched, 350 to 450. The tensile strength of deposit is 40,000 pounds per square inch and the compressive strength 177,000 pounds per square inch. Metallic arc deposited material has Brinell hardness of 240 to 400 when cooled slowly, and 240 when quenched. | The average hardness of grade No. 1 Stellite welding rod when applied as hard-facing is 512 Brinell; that of grade No. 12 is 444 Brinell; and that of No. 6 is 402 Brinell. The tensile strengths for the deposited hard-facing materials are: No. 1 grade, 40,000 pounds per square inch; No. 12 grade, 70,000 pounds per square inch; No. 6 grade, 86,000 pounds per square inch. | Haystellite set with Hascrome or High Test Steel and faced with Haynes Stellite or Haystellite Composite Rod produces a more wear-resistant surface than any other combination of hard-facing materials. |

MACHINERY'S Data Sheet No. 289, New Series, January, 1935

Based on data furnished by the Haynes Stellite Co.

DEFINITIONS OF TERMS RELATING TO DEFECTIVE CASTINGS

Blow-Hole—Ordinarily denotes a cavity of fairly large size in a casting, caused by entrapped gas. May result from defective condition of metal or of mold (including core).

Check—Synonymous with *Crack*, sometimes used to indicate a very narrow fissure.

Cold-Short—A term used ordinarily to describe a markedly brittle condition of a casting, noted when shocks or impacts are received. Due in some cases to very high phosphorus content, and resulting occasionally from other defects in chemical composition, or from heat-treatment of improper nature for the service. This term should not be confused with *Cold-Shot* or *Cold-Shut*.

Cold-Shot—Defines the condition apparent in a casting when, because of insufficiently hot steel or of improper mold condition, the metal fails to satisfactorily fill the mold cavity without causing seams, or poorly defined or missing details, etc., on the casting.

Cold-Shut—Synonymous with *Cold-Shot*.

Crack—Noun or verb employed to describe result or act of tearing the metal, during or after initial cooling. Very narrow ruptures are preferably called "checks" rather than "cracks," by some foundrymen, but these terms are used synonymously by many producers of castings.

Draw—Term employed for two distinct purposes. Occasionally used to describe an incipient shrinkage crack or hot tear in a corner or at the base of a pocket in a casting. Term also employed as noun or verb to indicate the result or act of withdrawing the pattern from the rammed sand.

Mis-Run—Similar to *Cold-Shot* in cause and appearance, but meaning, as ordinarily used, such a seriously missing portion of the casting as to cause rejection.

Pin-Hole—A cavity in a casting, of very small diameter, that is caused by entrapped gas. Usually elongated and found in groups. Presence of such cavities is observable after removal of an

nealing scale of minimum thickness, like that produced in effectively constructed and properly operated heat-treating furnaces (when metal composition permits oxidation).

Porosity—Term describing the condition characterized by *Pin-Holes*.

Poured-Short—Sometimes used synonymously with *Mis-Run*, but occasionally (and more properly) describing the condition resulting from insufficient metal in the ladle for filling the entire mold.

Sand-Cut—Noun or verb used to describe the result or act of erosion during pouring. May be caused by insufficient compression of the sand, by improper nature of the sand mixture, or by unskillful pouring. More apt to occur near the in-gate and at other locations where details of the mold are such as to offer particular resistance to the natural flow of the steel.

Scab—Noun or verb describing result or act of making a defective separation of the metal forming a portion of the surface of a casting. The scab is partially connected with the body of the casting in such a way as to necessitate a mechanical operation for removal, if the defect is not so serious as to justify rejection. Sand is present in the narrow cleavage plane. May be caused by improper condition of prepared facing, by improper compression of facing, and by other incorrect conditions.

Shift—Result of an inaccurate registration between two parts of the mold such as the cope and drag, or of improper placement of a core.

Strain—Verb or noun employed to describe act or result of an undesired yielding of the sand mold, causing an excessive dimension of part of the casting; generally produced by unskillful pouring or by insecurely attaching the upper and lower sections of the flask.

Swell—Noun or verb which is largely self-explanatory, ordinarily used to describe the result or act of forming an unintentional and irregular thickening of a section of a casting; usually due to inadequate compression of the sand.

MACHINERY'S Data Sheet No. 290, New Series, January, 1935

MACHINERY, January, 1935—272-A

Copyrighted by Electric Steel Foundry's Research Group, former publishers of "Research Group News," and reprinted by permission of E. A. Bull, former director of the Group, which was disbanded July 1, 1932.

DEFINITIONS OF STEEL FOUNDRY TERMS—1

TERMS RELATING TO EQUIPMENT

BACKDRAFT—Unintentional reversal of the tapered condition termed *draft*, defined in this glossary. Caused by faulty construction by pattern maker, either through carelessness or through misunderstanding of manner in which pattern or core-box must be withdrawn from rammed sand.

BOTTOM BOARD—A base, usually made of wood or metal, for retaining the rammed sand in the drag of a flask.

BULL LADLE—The large ladle that receives the metal from the furnace spout.

CHAPLET—A cast or wrought metallic spacing device, ordinarily of very thin sections, sometimes perforated, of such "working" length as to govern the desired local cross-section of the casting to be made; employed for securing the core at the proper distance from the surface of the mold cavity.

CHEEK—An intermediate, separable portion of a flask that has three or more vertical sections necessitated by complexity of molding. Infrequently required.

CHILL—An object variously designed (occasionally of special shape for the job), made of iron or steel, placed in mold or core, for accelerating the cooling of a section of a casting which would otherwise solidify so slowly as, possibly, to cause a defect. A chill may be so placed and of such nature as to directly facilitate the cooling of the surface or the interior of the casting.

COPE—The upper, separable portion of a flask that has two or more vertical sections.

CORE-PRINT—A term employed in connection with pattern and with mold. When related (properly) to pattern, the word indicates a special portion of it distinctively marked, to guide the molder in placing a core in the mold receptacle formed by the print. This receptacle the molder often also calls the core-print, because it represents an imprint or recess for the reception of a core.

DRAFT—Tapered condition of the pattern or core-box (the narrower portion being at the bottom as rammed), permitting its withdrawal from the compressed sand without excessive rapping or vibration and without disturbing the surface of the rammed sand.

DRAG—The lower, separable portion of a flask that has two or more vertical sections; or a flask section for a mold that requires neither

cheek nor cope, because of the simplicity of molding the casting.

FILLET—A term used in connection with pattern, mold, and casting. When related to pattern, the word indicates special equipment, usually made of leather, wood, or metal, to provide on the casting a radius instead of an angle at a junction of members. When related to mold or to casting, the word indicates the rounded corner formed by the corresponding feature of the pattern.

FLASK—A metal or wood box without a top and usually without a fixed bottom, to retain the sand forming a mold.

FLASK BAR—A cross-piece more often used in copes than in drags, frequently conforming in some degree to the general contour of the pattern, applied for the principal purpose of making the rammed mold more stable, and sometimes having the supplementary function of stiffening the flask section.

GAGGER—A steel or iron rod, ordinarily bent to a right angle at one or both ends, usually from 1/4 to 3/8 inch thick, rammed up in the cope of a flask to help in retaining the compressed sand. Occasionally spelled "jagger."

JAGGER—See *Gagger*.

LOOSE PIECE—Portion of pattern or of core-box, made detachable, often temporarily secured by dowels. Loose pieces are applied when such portions of the pattern, if permanently attached, would prevent satisfactory withdrawal after ramming. Occasionally, loose pieces are employed for making castings both right-handed and left-handed.

SHANK POT—Sometimes termed hand-ladle, consisting of a metal container having a refractory lining, suitable, when filled, for one, two, or three men to handle with a shank or carrier, the central portion of which is made in circular form to hold the receptacle for molten metal.

SPRUE-CUTTER—A power-operated machine for shearing the sprue, or down gate, or other portion of the gate assemblage of a casting, or any other similarly removable metal not forming part of the casting proper.

STOP-OFF—Term applied both to pattern and to core, indicating in either case construction that permits placement of core by means of a projection on it, provided by the pattern. This projection is frequently required for placing a core to form a hole through a wall cast vertically.

DEFINITIONS OF STEEL FOUNDRY TERMS—2

TERMS RELATING TO MOLDING

CHECKING (OR CRACKING) STRIPS (OR BRACKETS)—Braces of thin cross-sections integrally formed on castings (ordinarily removed in the cleaning room), produced by auxiliary pieces on pattern or in core-box, or by filing a mold or core; placed at right angles to locations susceptible to shrinkage cracks to aid the casting in resisting contraction strains while solidifying.

CORE WASH—A solution of similar character to that of *mold wash*, used for a similar purpose, but with respect to a core.

DOWN GATE—Synonymous with *sprue*.

GATE—Sometimes employed as a general term to indicate the entire assemblage of connected column and channels carrying the metal from the top of the mold to that part of it forming the casting proper; but frequently denoting that portion of the gate assemblage occasionally called the in gate, which connects the casting proper to the runner or to the column which is termed the *sprue* or down gate.

HEAD (OR HEADER)—Synonymous with *riser*.

MOLD WASH—A solution usually containing a liquid binder such as molasses, and finely pouring cup.

ON THE COLD SIDE—Phrase employed to express the condition of liquid steel that is not as hot as normal.

RED-SHORT—Term employed to describe the condition of low resistance typical of steel and all other metals after pouring while they are red-hot. Red-shortness of excessive degree, which may result from a very high sulphur content, manifests itself in tendencies to form shrinkage cracks not typical of normal grades of steel.

TAP—Verb used to describe act of emptying a furnace.

TEEM—Verb occasionally employed to indicate the pouring of metal from the ladle.

WILD—A term used to indicate an objectionable, obviously gaseous, condition of the metal.

CUP—Verb used to denote the natural tendency of properly degassed metal, when poured in a satisfactory mold, to contract at the top of the sprue or down gate.

DEAD—Term denoting perfectly quiet condition of metal.

FEED—Verb used to indicate the function of a riser in supplying the voids formed by contraction of the solidifying metal.

FREEZE—Term used on the foundry floor synonymously with "solidify," as employed elsewhere.

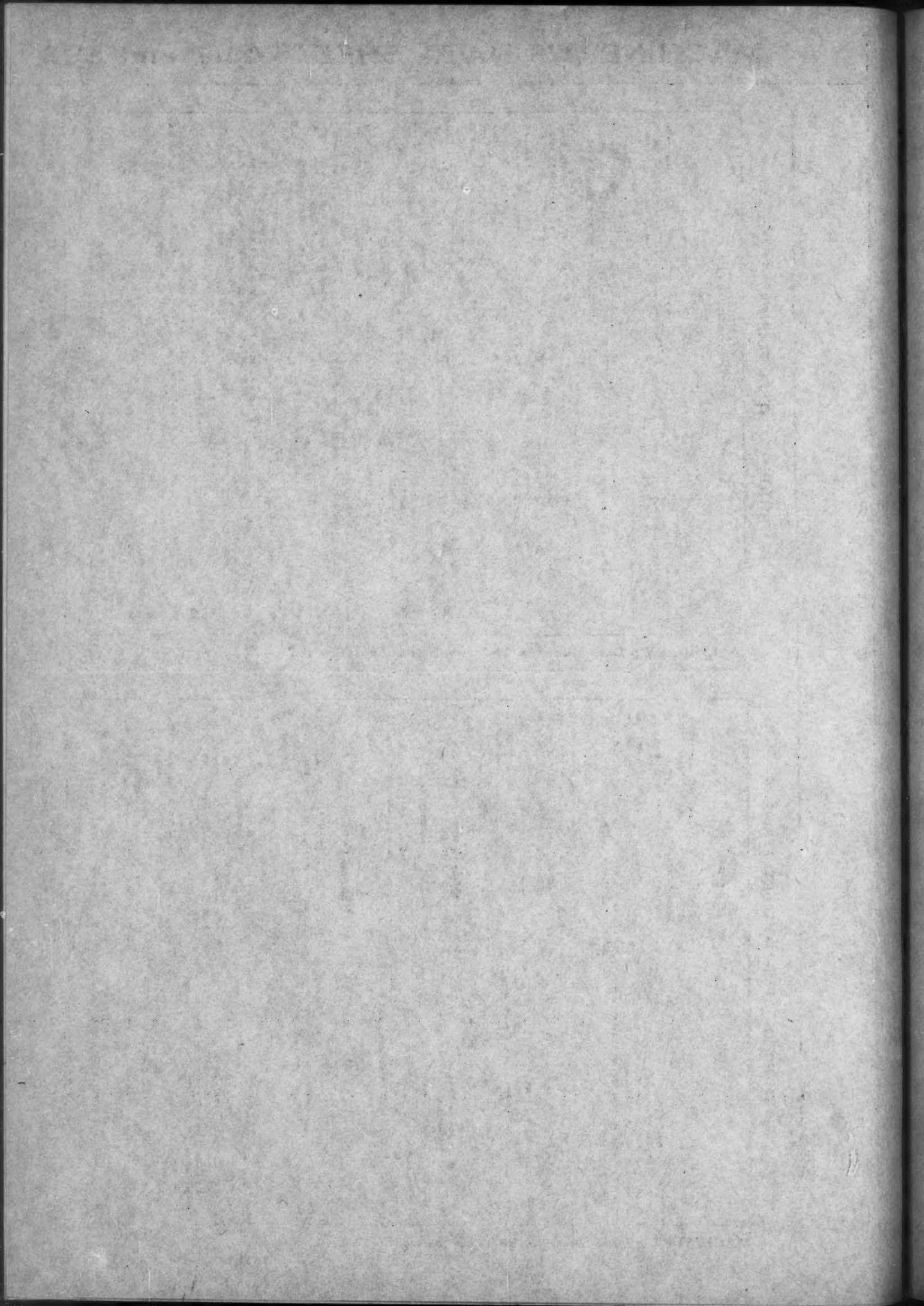
KILL—Term used to describe operation of quieting steel, by adding a degassing material.

MUSHROOM—Verb indicating tendency observed at the top of the sprue or down gate to expand in size, caused by excessive gas which enlarges volume of metal solidifying in pouring cup.

MACHINERY'S Data Sheet No. 291, New Series, February, 1935

MACHINERY'S Data Sheet No. 292, New Series, February, 1935

MACHINERY, February, 1935—336-A



GEAR MATERIALS AND BLANKS—1 Recommended Practice for Bronze and Brass Castings

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|-----------|--------|-------|-----|------|------|-------|-------------------|------|----------------------------|------|--------|-----------|-----|------|------|------|------------|-----------|-------------|------|-------------------------|------|
| <p>General</p> <p>1. <i>Material Covered</i>—These specifications cover non-ferrous metals for spur, bevel, and worm gears, bushings, and flanges for composition gears.</p> <p>2. <i>Basis of Purchase</i>—This material shall be purchased on the basis of chemical composition.</p> <p>3. <i>Process</i>—The alloys may be made by any approved method.</p> <p>Use and Chemical Composition</p> <p>4. (a)—For spur and bevel gears, hard cast bronze, A. S. T. M. B-10-18, S. A. E. No. 62, and the well-known 88-10-2 mixture to the following limits are recommended:</p> <table> <tr><td>Copper</td><td>86-89</td></tr> <tr><td>Tin</td><td>9-11</td></tr> <tr><td>Lead</td><td>1-2.5</td></tr> <tr><td>Phosphorus (max.)</td><td>0.25</td></tr> <tr><td>Zinc and impurities (max.)</td><td>0.50</td></tr> </table> <p>(b)—For bronze worm-gears, two alternative analyses of phosphor-bronze are recommended—S. A. E. No. 65 and No. 63. S. A. E. No. 65, called phosphor gear bronze, has the following analysis:</p> <table> <tr><td>Copper</td><td>78.5-81.5</td></tr> <tr><td>Tin</td><td>9-11</td></tr> <tr><td>Lead</td><td>9-11</td></tr> <tr><td>Phosphorus</td><td>0.05-0.25</td></tr> <tr><td>Zinc (max.)</td><td>0.75</td></tr> <tr><td>Other impurities (max.)</td><td>0.35</td></tr> </table> | | Copper | 86-89 | Tin | 9-11 | Lead | 1-2.5 | Phosphorus (max.) | 0.25 | Zinc and impurities (max.) | 0.50 | Copper | 78.5-81.5 | Tin | 9-11 | Lead | 9-11 | Phosphorus | 0.05-0.25 | Zinc (max.) | 0.75 | Other impurities (max.) | 0.35 |
| Copper | 86-89 | | | | | | | | | | | | | | | | | | | | | | |
| Tin | 9-11 | | | | | | | | | | | | | | | | | | | | | | |
| Lead | 1-2.5 | | | | | | | | | | | | | | | | | | | | | | |
| Phosphorus (max.) | 0.25 | | | | | | | | | | | | | | | | | | | | | | |
| Zinc and impurities (max.) | 0.50 | | | | | | | | | | | | | | | | | | | | | | |
| Copper | 78.5-81.5 | | | | | | | | | | | | | | | | | | | | | | |
| Tin | 9-11 | | | | | | | | | | | | | | | | | | | | | | |
| Lead | 9-11 | | | | | | | | | | | | | | | | | | | | | | |
| Phosphorus | 0.05-0.25 | | | | | | | | | | | | | | | | | | | | | | |
| Zinc (max.) | 0.75 | | | | | | | | | | | | | | | | | | | | | | |
| Other impurities (max.) | 0.35 | | | | | | | | | | | | | | | | | | | | | | |
| <p>Good castings made of this alloy should give the following minimum physical characteristics:</p> <p>Ultimate strength . . . 35,000 lbs. per sq. in. Yield point 20,000 lbs. per sq. in. Elongation in 2 inches 10 per cent</p> <p>S. A. E. No. 63, called leaded gun metal, has the following analysis:</p> <table> <tr><td>Copper</td><td>86-89</td></tr> <tr><td>Tin</td><td>9-11</td></tr> <tr><td>Lead</td><td>1-2.5</td></tr> <tr><td>Phosphorus (max.)</td><td>0.25</td></tr> <tr><td>Zinc and impurities (max.)</td><td>0.50</td></tr> </table> <p>Good castings made of this alloy should give the following minimum physical characteristics:</p> <p>Ultimate strength . . . 30,000 lbs. per sq. in. Yield point 12,000 lbs. per sq. in. Elongation in 2 inches 10 per cent</p> <p>These alloys, especially No. 65, are adapted to chilling for hardness and refinement of grain. No. 65 is to be preferred for use with worms of great hardness and fine accuracy. No. 63 is to be preferred for use with unhardened worms.</p> <p>(c)—For bronze bushings for gears, S. A. E. No. 64 is recommended, of the following analysis:</p> <table> <tr><td>Copper</td><td>78.5-81.5</td></tr> <tr><td>Tin</td><td>9-11</td></tr> <tr><td>Lead</td><td>9-11</td></tr> <tr><td>Phosphorus</td><td>0.05-0.25</td></tr> <tr><td>Zinc (max.)</td><td>0.75</td></tr> <tr><td>Other impurities (max.)</td><td>0.35</td></tr> </table> <p>Good castings of this alloy should give the following minimum physical characteristics:</p> <p>Ultimate strength . . . 25,000 lbs. per sq. in. Yield point 12,000 lbs. per sq. in. Elongation in 2 inches 8 per cent</p> | | Copper | 86-89 | Tin | 9-11 | Lead | 1-2.5 | Phosphorus (max.) | 0.25 | Zinc and impurities (max.) | 0.50 | Copper | 78.5-81.5 | Tin | 9-11 | Lead | 9-11 | Phosphorus | 0.05-0.25 | Zinc (max.) | 0.75 | Other impurities (max.) | 0.35 |
| Copper | 86-89 | | | | | | | | | | | | | | | | | | | | | | |
| Tin | 9-11 | | | | | | | | | | | | | | | | | | | | | | |
| Lead | 1-2.5 | | | | | | | | | | | | | | | | | | | | | | |
| Phosphorus (max.) | 0.25 | | | | | | | | | | | | | | | | | | | | | | |
| Zinc and impurities (max.) | 0.50 | | | | | | | | | | | | | | | | | | | | | | |
| Copper | 78.5-81.5 | | | | | | | | | | | | | | | | | | | | | | |
| Tin | 9-11 | | | | | | | | | | | | | | | | | | | | | | |
| Lead | 9-11 | | | | | | | | | | | | | | | | | | | | | | |
| Phosphorus | 0.05-0.25 | | | | | | | | | | | | | | | | | | | | | | |
| Zinc (max.) | 0.75 | | | | | | | | | | | | | | | | | | | | | | |
| Other impurities (max.) | 0.35 | | | | | | | | | | | | | | | | | | | | | | |

MACHINERY'S Data Sheet No. 293, New Series, March, 1935

Based on recommended practices approved by American Standards Association, July, 1933

GEAR MATERIALS AND BLANKS—2 Recommended Practice for Bronze and Brass Castings

| | | | | | | | | | | | | | | | |
|--|---------|--------|-------|-----|---------|------|---------|------|---------|-------------|------|-----------------|------|----------|------|
| <p>Use and Chemical Composition</p> <p>(d)—For brass flanges for composition pinions, A. S. T. M. B-30-32T, and S. A. E. No. 40 are recommended. This is a good cast red brass of sufficient strength and hardness to take its share of load and wear under conditions of style No. 2 of the A. G. M. A. standards for composition gearing, a design in which the flanges mesh with the mating gear, and therefore ample for style No. 1. The composition is as follows:</p> <table> <tr><td>Copper</td><td>83-86</td></tr> <tr><td>Tin</td><td>4.5-5.5</td></tr> <tr><td>Lead</td><td>4.5-5.5</td></tr> <tr><td>Zinc</td><td>4.5-5.5</td></tr> <tr><td>Iron (max.)</td><td>0.35</td></tr> <tr><td>Antimony (max.)</td><td>0.35</td></tr> <tr><td>Aluminum</td><td>None</td></tr> </table> <p>Good castings made from this alloy should give the following minimum physical characteristics:</p> <p>Ultimate strength . . . 27,000 lbs. per sq. in. Yield point 12,000 lbs. per sq. in. Elongation in 2 inches 16 per cent</p> <p>Chemical Analysis</p> <p>5—An analysis of each melt shall be made by the manufacturer. The chemical composition thus determined shall be reported to the purchaser or his representative and shall conform to the above specifications.</p> <p>Sampling</p> <p>6. (a)—The sample for chemical analysis may be taken either by sawing, drilling, or milling the casting, or test coupon, and shall represent the average cross-section of the piece.</p> <p>(b)—The saw, drill, cutter, or other tool used shall be thoroughly cleaned. No lubricant shall be used in the operation, and the sawdust or metal chips shall be carefully treated with a magnet to remove any particles of iron.</p> <p>Inspection</p> <p>7. (a)—Inspection may be made at the manufacturer's works where the castings are made or at the point at which they are received, at the option of the purchaser.</p> <p>(b)—If the purchaser elects to have inspection made at the manufacturer's works, the inspector representing the purchaser shall have free entry at all times while work on the contract of the purchaser is being performed to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works.</p> <p>Rejection</p> <p>8—Castings showing injurious defects revealed by machining operations subsequent to acceptance may be rejected, and if rejected, shall be replaced by the manufacturer free of cost to the purchaser. The full weight of the original material rejected shall be returned to the manufacturer.</p> | | Copper | 83-86 | Tin | 4.5-5.5 | Lead | 4.5-5.5 | Zinc | 4.5-5.5 | Iron (max.) | 0.35 | Antimony (max.) | 0.35 | Aluminum | None |
| Copper | 83-86 | | | | | | | | | | | | | | |
| Tin | 4.5-5.5 | | | | | | | | | | | | | | |
| Lead | 4.5-5.5 | | | | | | | | | | | | | | |
| Zinc | 4.5-5.5 | | | | | | | | | | | | | | |
| Iron (max.) | 0.35 | | | | | | | | | | | | | | |
| Antimony (max.) | 0.35 | | | | | | | | | | | | | | |
| Aluminum | None | | | | | | | | | | | | | | |

MACHINERY'S Data Sheet No. 294, New Series, March, 1935

Based on recommended practices approved by American Standards Association, July, 1933

MACHINERY'S DATA SHEETS 295 and 296

GEAR MATERIALS AND BLANKS—3 Recommended Practice for Forged and Rolled Steel

Carbon Steel

1. **Material Covered**—This specification covers carbon steel for gears in three groups, according to heat-treatment, as follows: (a) casehardened gears; (b) unhardened gears, not heat-treated after machining; and (c) hardened and tempered gears.

2. **Basis of Purchase**—Forged and rolled carbon

gear steels shall be purchased on the basis of the requirements as to chemical composition specified in Table 1. Class N steel will normally be ordered in ten-point carbon ranges within these limits. Physical properties have been omitted, but when specified, the requirements as to carbon shall be omitted.

Table 1. Chemical Composition of Forged and Rolled Carbon Steel

| Use | Class | Carbon | Manganese | Phosphorus | Sulphur |
|-------------------------------|-------|-----------|-----------|------------|------------|
| Casehardened ... | C | 0.15–0.25 | 0.40–0.70 | 0.045 max. | 0.055 max. |
| Untreated | N | 0.25–0.50 | 0.50–0.80 | 0.045 max. | 0.055 max. |
| Hardened (or untreated) | H | 0.40–0.50 | 0.40–0.70 | 0.045 max. | 0.055 max. |

Alloy Steel

1. **Material Covered**—This specification covers alloy steel for gears in two classes, according to heat-treatment, as follows: (a) casehardened gears, and (b) hardened and tempered gears.

2. **Basis of Purchase**—Forged and rolled alloy gear steels shall be purchased on the basis of the chemical composition specified in Table 2. Requirements as to physical properties have been omitted.

Table 2. Chemical Composition of Forged and Rolled Alloy Steel

| S A E Steel Number | Carbon | Manganese | Phosphorus Max. | Sulphur Max. | Nickel | Chrome | Vanadium | | Molybdenum |
|--------------------------|-----------|-----------|--------------------|-----------------|-----------|-----------|----------|---------|------------|
| | | | | | | | Min. | Desired | |
| 2315 | 0.10–0.20 | 0.30–0.60 | 0.04 | 0.05 | 3.25–3.75 | ..... | .... | .... | ..... |
| 2350 | 0.45–0.55 | 0.50–0.80 | 0.04 | 0.05 | 3.25–3.75 | ..... | .... | .... | ..... |
| 2512 | 0.17 max. | 0.30–0.60 | 0.04 | 0.05 | 4.75–5.25 | ..... | .... | .... | ..... |
| 3115 | 0.10–0.20 | 0.30–0.60 | 0.04 | 0.05 | 1.00–1.50 | 0.45–0.75 | .... | .... | ..... |
| 3215 | 0.10–0.20 | 0.30–0.60 | 0.04 | 0.045 | 1.50–2.00 | 0.90–1.25 | .... | .... | ..... |
| 3250 | 0.45–0.55 | 0.30–0.60 | 0.04 | 0.045 | 1.50–2.00 | 0.90–1.25 | .... | .... | ..... |
| 3312 | 0.17 max. | 0.30–0.60 | 0.04 | 0.045 | 3.25–3.75 | 1.25–1.75 | .... | .... | ..... |
| 3340 | 0.35–0.45 | 0.30–0.60 | 0.04 | 0.045 | 3.25–3.75 | 1.25–1.75 | .... | .... | ..... |
| 6120 | 0.15–0.25 | 0.30–0.60 | 0.04 | 0.045 | ..... | 0.80–1.10 | 0.15 | 0.18 | ..... |
| 6150 | 0.45–0.55 | 0.50–0.80 | 0.04 | 0.045 | ..... | 0.80–1.10 | 0.15 | 0.18 | ..... |
| 4615 | 0.10–0.20 | 0.30–0.60 | 0.04 | 0.05 | 1.50–2.00 | ..... | .... | .... | 0.20–0.30 |

MACHINERY'S Data Sheet No. 295, New Series, April, 1935

Based on recommended practice approved by American Standards Association, July, 1933

GEAR MATERIALS AND BLANKS—4

Recommended Practice for Forged and Rolled Steel*

Manufacture

Process—The steels may be made by either the open-hearth or electric furnace process or by both.

Discard—A sufficient discard shall be made from each ingot to secure freedom from injurious piping and undue segregation.

Ladle Analysis

An analysis of each melt of steel shall be made by the manufacturer to determine the percentages of the elements specified. This analysis shall be made from drillings taken at least 1/8 inch beneath the surface of a test ingot obtained during the pouring of the melt. The chemical composition thus determined shall be reported to the purchaser or his representative, and shall conform to the requirements specified.

Check Analysis

Analyses may be made by the purchaser from one or more bars or forgings representing each melt. The chemical composition thus determined shall conform to the requirements specified in the tables in Data Sheet No. 295 for carbon and alloy steels. Drillings for the analysis of carbon steel shall be taken at any point not closer to the center than midway between the center and the surface, but not within 1/8 inch of the surface of the bar or forgings. Drillings for the analysis of alloy steels may be taken at any point midway between the center and the surface of solid forgings or bars, or cuttings may be taken off the entire end surface; when sampling, the surface material for a depth of at least 1/8 inch shall be discarded.

Finish

The material shall be free from injurious defects and shall have a work-

manlike finish. Cold-finished bars shall have a bright, smooth surface.

Marking

(a) The melt number shall be legibly stamped on each bar or forging 4 inches or over in thickness, and on those of smaller section when so specified.

(b) The identification marks specified on the order to be stamped on gear blanks shall be placed on the web or in such a position that they will not be obliterated in machining.

Inspection

The inspector representing the purchaser shall have free entry at all times while work on the contract of the purchaser is being performed to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications.

Rejection

(a) Unless otherwise specified, any rejection based on tests made in accordance with this specification shall be reported within ten working days from the receipt of samples.

(b) Material that shows injurious defects while being finished by the purchaser will be rejected, and the manufacturer shall be notified.

Rehearing

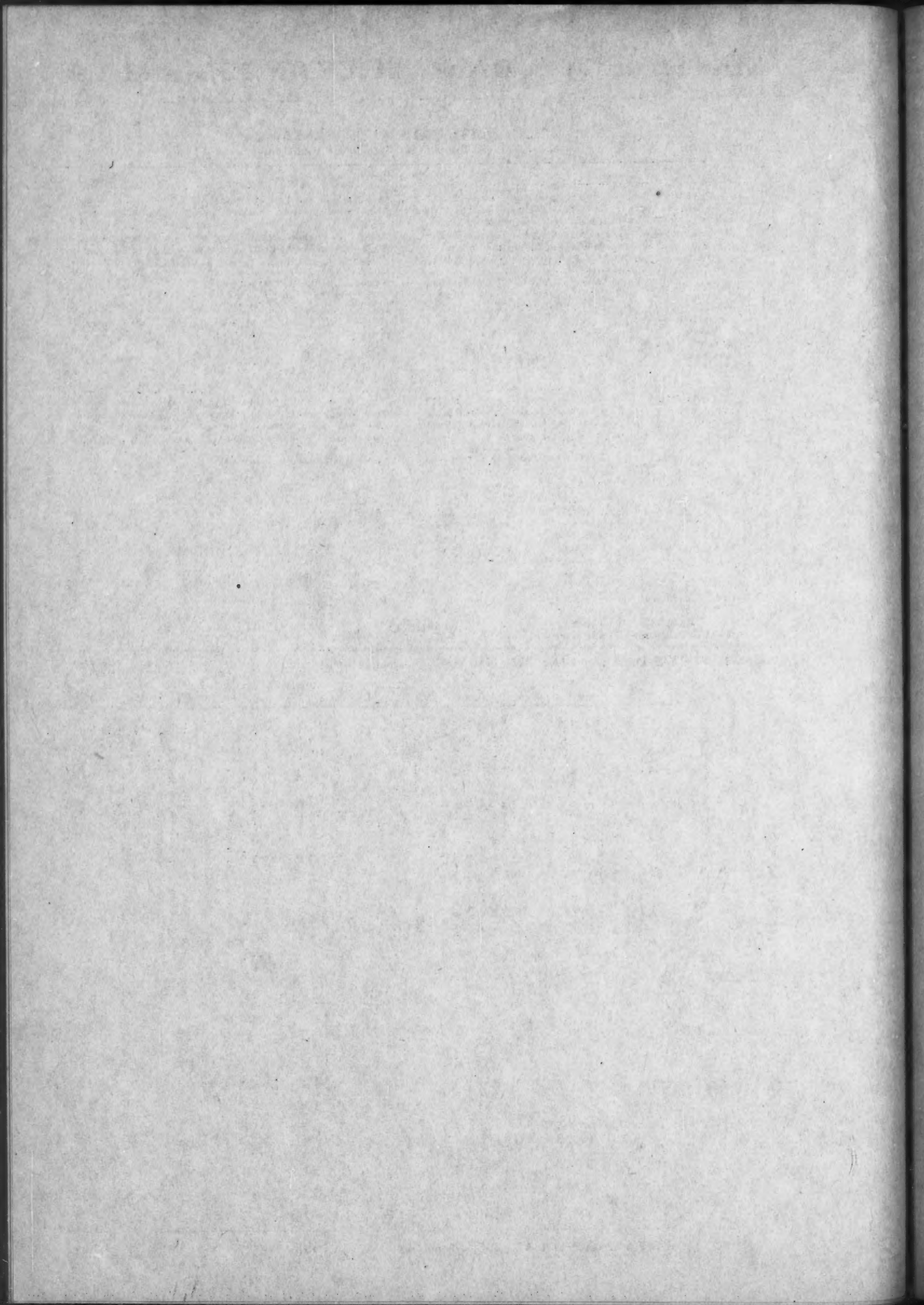
Samples tested in accordance with this specification which represent rejected material shall be preserved for two weeks from date of test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

* Applies to both carbon and alloy steels

MACHINERY'S Data Sheet No. 296, New Series, April, 1935

Based on recommended practice approved by American Standards Association, July, 1933

MACHINERY, April, 1935—496-A



GEAR MATERIALS AND BLANKS—5

Recommended Practice for Steel Castings

It is recommended that steel castings for cut gears be made by the open-hearth, crucible, or electric furnace process, and that they be purchased on the basis of the chemical analyses given in the accompanying table.

Sufficient risers shall be provided to secure soundness and freedom from undue segregation. Risers shall not be broken off the unannealed castings by force, and when cut off with a torch, the cut shall be at least 1/2 inch above the surface of the castings, the remaining metal being removed by chipping, grinding, or other non-injurious method.

Heat-Treatment and Analysis

All steel castings for gears must be thoroughly normalized or annealed, using such temperature and time as will entirely eliminate the characteristic structure of unannealed castings.

Drillings taken at least 1/8 inch beneath the surface of a test ingot obtained during the pouring of each melt shall be analyzed by the manufacturer to determine the percentages of the elements specified. The chemical composition of each melt thus determined shall be reported to the purchaser and shall conform to the requirements specified.

Analyses may be made by the purchaser from one or more castings, representing each melt. The chemical composition thus determined shall conform to the requirements specified. Drillings for such analyses shall be taken at any point not closer to the center than midway between the center and the surface, but not within 1/8 inch of the surface of the casting.

The castings shall conform substantially to the shapes and sizes indicated by

the patterns or drawings submitted by the purchaser. When dimensioned drawings are provided, the foundry shall take all responsibility for correctness as to shrinkage.

The castings shall be free from injurious defects. Defects that do not impair the strength of the castings may be welded by an approved process in a manner satisfactory to the purchaser. All steel castings welded by the foundry shall be heat-treated after welding before delivery to the purchaser.

Marking, Inspection, and Rejection

The melt number and foundry symbol shall be legibly stamped or cast on each casting 6 inches or over in thickness or diameter, and on castings of smaller section when so specified.

The inspector representing the purchaser shall have free entry at all times while work on the contract of the purchaser is being performed to all parts of the manufacturer's works which concern the manufacture of the castings ordered, and the manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the castings are being furnished in accordance with these specifications.

Castings that show injurious defects or fail to pass the check examinations as to chemistry or heat-treatment subsequent to their acceptance at the manufacturer's works shall be rejected and the manufacturer shall be notified.

Samples tested by the purchaser which represent rejected castings shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the test, the manufacturer may make claim for a re-hearing within that time.

| Use | Class | Carbon | Manganese | Phosphorus | | Sulphur |
|--------------------------|-------|-----------|-----------|------------|-----------|-----------|
| | | | | Acid | Basic | |
| Casehardened. | C | 0.15-0.25 | 0.40-0.60 | 0.06 max. | 0.05 max. | 0.06 max. |
| Untreated or Hardened... | H | 0.30-0.40 | 0.40-0.60 | 0.06 max. | 0.05 max. | 0.06 max. |

MACHINERY'S Data Sheet No. 297, New Series, May, 1935

Based on recommended practice approved by American Standards Association, July, 1933

MACHINEABILITY AND HARDNESS DATA FOR COLD-DRAWN STEEL

MACHINEABILITY—Considering the machineability of SAE 1112 steel as a standard of 100, the machineability of other grades in relation to this standard is given in the following table in the descending order of suitability.

| Material | Machineability Rating (SAE 1112 = 100) | Material | Machineability Rating (SAE 1112 = 100) |
|--------------------------|--|------------------------|--|
| High-Sulphur Bessemer... | 120 | SAE 1335 Annealed | 65 |
| SAE 1112 | 100 | SAE 1045 Annealed | 60 |
| X-1315 | 85 | SAE 1040 | 60 |
| X-1314 | 85 | SAE 1035 | 60 |
| SAE 1120 | 80 | SAE 1020 | 60 |
| X-1335 | 75 | SAE 6115 | 60 |
| SAE 6185 Annealed | 65 | SAE 4615 | 60 |
| SAE 4130 Annealed | 65 | SAE 2345 Annealed | 60 |
| SAE 2330 Annealed | 65 | SAE 3115 | 55 |
| SAE 4140 Annealed | 65 | SAE 1015 | 55 |
| SAE 3140 Annealed | 65 | SAE 2315 | 55 |

*These rating figures are, of course, only approximate.

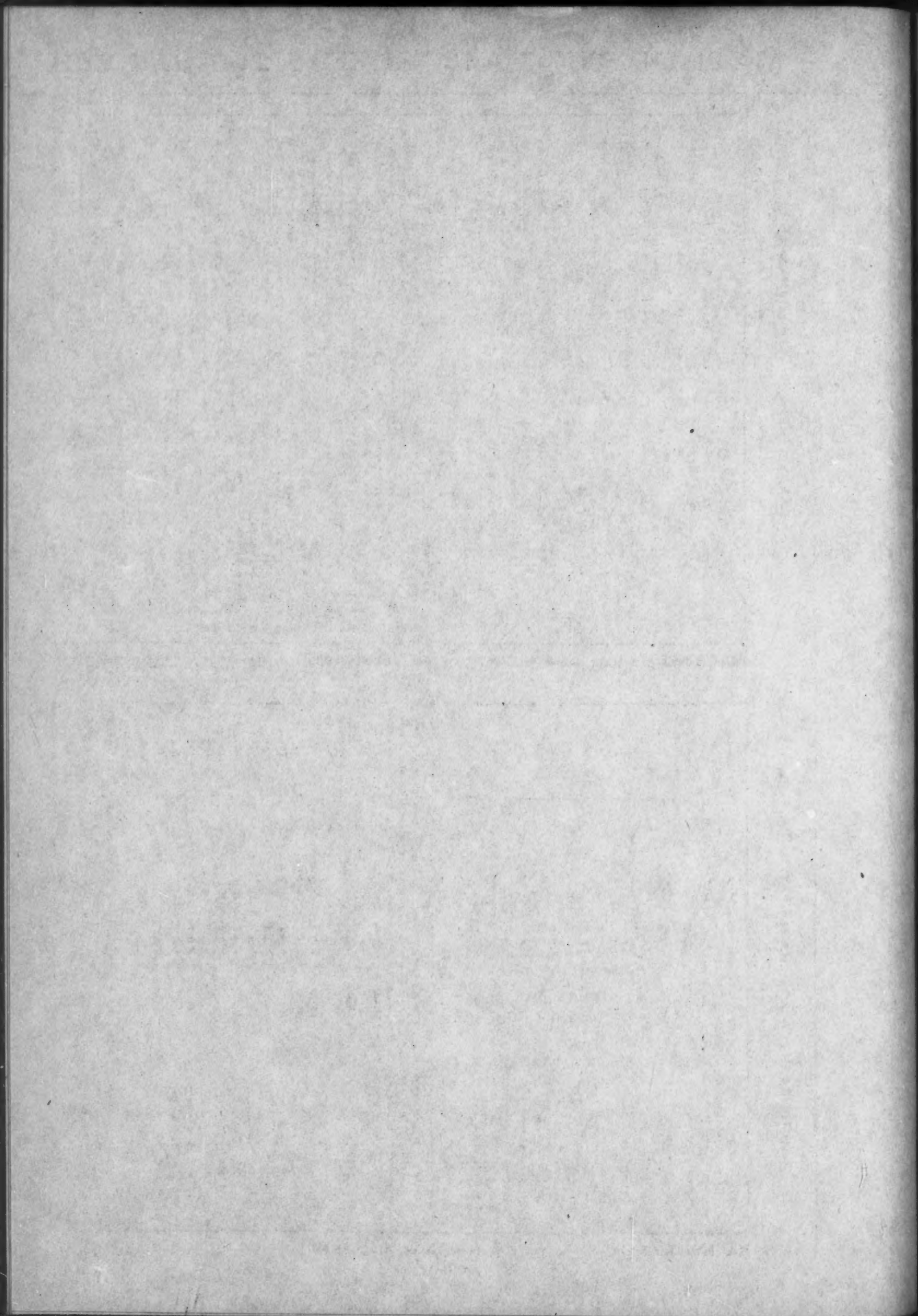
The following **BRINELL HARDNESS** numbers are approximate averages. They are based on 1-inch diameter bars—cold-drawn. In most cases, smaller sizes will be somewhat harder and larger sizes slightly softer than the figure given. For hardness of turned bars, deduct about 15 per cent from the figure given.

| Material | Brinell Hardness Number | Material | Brinell Hardness Number |
|--------------------------|-------------------------|------------------------|-------------------------|
| High-Sulphur Bessemer... | 183 | SAE 3140 Annealed | 201 |
| SAE 1112 | 183 | SAE 1335 Annealed | 197 |
| X-1315 | 167 | SAE 1045 Annealed | 192 |
| X-1314 | 159 | SAE 1040 | 187 |
| SAE 1120 | 153 | SAE 1035 | 174 |
| X-1335 | 192 | SAE 1020 | 153 |
| SAE 6185 Annealed | 192 | SAE 6115 | 192 |
| SAE 4130 Annealed | 197 | SAE 4615 | 192 |
| SAE 2330 Annealed | 197 | SAE 2345 Annealed | 201 |
| SAE 2330 Not Annealed | 241 | SAE 3115 | 201 |
| SAE 4140 Annealed | 201 | SAE 1015 | 143 |
| ..... | ... | SAE 2315 | 192 |

A rapid way to figure relation between a Brinell Hardness number and tensile strength is to use a ratio of 1 to 500, that is, 202 Brinell times 500 equals 101,000. The use of the Rockwell "C" scale at hardnesses less than 30 or the use of a Brinell at hardnesses of over 600 is not recommended.

MACHINERY'S Data Sheet No. 298, New Series, May, 1935

Based on a Compilation by the Wyckoff Drawn Steel Co.



MACHINERY'S DATA SHEETS 299 and 300

APPLICATIONS OF NICKEL ALLOY STEELS AND IRONS IN THE TOOL AND DIE FIELD (Arranged in Order of Suitability for Increasing Severity of Service)

| Application | Material Used* | Treatment | Application | Material Used* | Treatment |
|--|---|---------------------------|---|--|----------------------|
| Arbors | SAE 3120, SAE 4615 | Case-hardened | Dies: | | |
| | SAE 4370 | Oil-hardened | Molding, for plastics | SAE 3110, 2% Ni ingot iron | Case-hardened |
| Boring-bars | SAE 3145, SAE 3160, SAE 4650, SAE 3240 | Oil-hardened | Pressing and striking | Cast iron—Type 5 | Heat-treated |
| Broaches | SAE 4615, SAE 2315, SAE 3312 | Case-hardened | Gages, ring and thread | SAE 4370 | Oil-hardened |
| Chalking tools | SAE 2340, SAE 3340 | Oil-hardened | Hacksaw blades.. | Ni-W | Oil-hardened |
| Chisels | SAE 4650, SAE 2340 SAE 3340 | Oil- or air-hardened | Hammer heads .. | SAE 2340 | Oil-hardened |
| Collets and collet fingers | SAE 3120, SAE 4615, SAE 2315 SAE 4370, SAE 3270 | Case-hardened | Hammer blocks and anvils | Cast iron—Types 2 and 4 | Oil- or air-hardened |
| Dies: | | Oil-hardened | Hobs | SAE 3250 | Oil- or air-hardened |
| Automobile body and sheet metal work | Cast iron—Types 1, 2, 3, and 4 | As cast or heat-treated | Hot shearing knives | SAE 4345, SAE 2340 | Oil-hardened |
| Blanking | SAE 3430, SAE 3440 | Oil-quenched from cyanide | Knives, circular and wood planing | Ni-W | |
| | SAE 3455, SAE 3350 | Oil-hardened | Milling and reaming cutter bodies | SAE 3240, SAE 3330 | Oil-hardened |
| Cold-heading .. | Ni-W, SAE 4345 | Oil-hardened | Milling cutters .. | Ni-W | |
| Die-casting | SAE 3150 | Oil-hardened | Punches | SAE 3250 | Oil-hardened |
| Deep-drawing .. | Ni-W | Oil-hardened | Rams, hydraulic. | SAE 3250 | Oil-hardened |
| Drop-forging .. | SAE 2160, SAE 3150, SAE 4355, SAE 3440 | Oil-hardened | Saws: | | |
| | Cast iron—Types 6, 7, and 8 | As cast or heat-treated | Band | 2% nickel high-carbon | Oil-hardened |
| Forming | SAE 3250 | Oil-hardened | Circular | 2% nickel high-carbon | Oil-hardened |
| | Cast iron—Types 1, 2, 3, and 4 | As cast or heat-treated | Circular, center disks | SAE 2330 | Not heat-treated |
| Hot work | Ni-Cr-W-Mo | Oil-hardened | Screwdrivers | SAE 3150, SAE 4650, SAE 3250, SAE 4350 | Oil-hardened |
| | | | Wrenches | SAE 3150, SAE 4650, SAE 3250 | Oil-hardened |

*For chemical composition of steels and irons referred to in this data sheet, see Data Sheet No. 300.

Compiled by J. W. Sands, Development and Research Department, International Nickel Co.

MACHINERY'S Data Sheet No. 299, New Series, June, 1935

COMPOSITION OF NICKEL ALLOY STEELS AND IRONS USED IN TOOL AND DIE FIELD

| Composition of Casehardening Steels, Per Cent | | | | | |
|---|--------------|-----------|------------|-----------|-----------|
| Type of Steel | Carbon | Manganese | Silicon | Nickel | Chromium |
| SAE 2315 | 0.10-0.20 | 0.30-0.60 | 0.15-0.30 | 3.25-3.75 | 0.45-0.75 |
| SAE 3110 | 0.05-0.15 | 0.30-0.60 | 0.15-0.30 | 1.00-1.50 | 0.45-0.75 |
| SAE 3120 | 0.15-0.25 | 0.30-0.60 | 0.15-0.30 | 1.00-1.50 | 1.25-1.75 |
| SAE 3312 | Max. 0.17 | 0.30-0.60 | 0.15-0.30 | 3.25-3.75 | 0.20-0.30 |
| SAE 4615 | 0.10-0.20 | 0.40-0.70 | 0.15-0.30 | 1.65-2.00 | 0.20-0.30 |
| 2% Nickel Ingot Iron | Max. 0.05 | 0.13-0.18 | ..... | 2.00-2.25 | ..... |
| Composition of Oil-Hardening Steels, Per Cent | | | | | |
| Type of Steel | Carbon | Manganese | Silicon | Nickel | Chromium |
| SAE 2160 | 0.55-0.65 | 0.50-0.80 | 0.15-0.30 | 1.25-1.75 | ..... |
| SAE 2330 | 0.25-0.35 | 0.50-0.80 | 0.15-0.30 | 3.25-3.75 | ..... |
| SAE 2340 | 0.35-0.45 | 0.60-0.90 | 0.15-0.30 | 3.25-3.75 | ..... |
| SAE 3145 | 0.40-0.50 | 0.60-0.90 | 0.15-0.30 | 1.00-1.50 | 0.45-0.75 |
| SAE 3150 | 0.45-0.55 | 0.60-0.90 | 0.15-0.30 | 1.00-1.50 | 0.45-0.75 |
| SAE 3160 | 0.55-0.65 | 0.50-0.80 | 0.15-0.30 | 1.00-1.50 | 0.45-0.75 |
| SAE 3240 | 0.35-0.45 | 0.30-0.60 | 0.15-0.30 | 1.50-2.00 | 0.90-1.25 |
| SAE 3250 | 0.45-0.55 | 0.30-0.60 | 0.15-0.30 | 1.50-2.00 | 0.90-1.25 |
| SAE 3270 | 0.65-0.75 | 0.30-0.60 | 0.15-0.30 | 1.50-2.00 | 0.90-1.25 |
| SAE 3330 | 0.25-0.35 | 0.30-0.60 | 0.15-0.30 | 3.25-3.75 | 1.25-1.75 |
| SAE 3340 | 0.35-0.45 | 0.30-0.60 | 0.15-0.30 | 3.25-3.75 | 1.25-1.75 |
| SAE 3350 | 0.45-0.55 | 0.30-0.60 | 0.15-0.30 | 3.25-3.75 | 1.25-1.75 |
| SAE 3430 | 0.25-0.35 | 0.30-0.60 | 0.15-0.30 | 2.75-3.25 | 0.60-0.95 |
| SAE 3440 | 0.35-0.45 | 0.30-0.60 | 0.15-0.30 | 2.75-3.25 | 0.60-0.95 |
| SAE 3455 | 0.50-0.60 | 0.30-0.60 | 0.15-0.30 | 2.75-3.25 | 0.60-0.95 |
| SAE 4345 | 0.40-0.50 | 0.50-0.80 | 0.15-0.30 | 1.50-2.00 | 0.60-0.90 |
| SAE 4350 | 0.45-0.55 | 0.50-0.80 | 0.15-0.30 | 1.50-2.00 | 0.60-0.90 |
| SAE 4355 | 0.50-0.60 | 0.50-0.80 | 0.15-0.30 | 1.50-2.00 | 0.60-0.90 |
| SAE 4370 | 0.65-0.75 | 0.50-0.80 | 0.15-0.30 | 1.50-2.00 | 0.60-0.90 |
| SAE 4650 | 0.45-0.55 | 0.40-0.70 | 0.15-0.30 | 1.65-2.00 | 0.60-0.90 |
| 2% Nickel-High C. | 0.65-0.75 | 0.50-0.80 | 0.15-0.30 | 1.75-2.25 | ..... |
| Nickel-Tungsten* | 0.82-0.92 | 0.50-0.80 | 0.15-0.30 | 0.50-0.70 | ..... |
| Ni-Cr-W-Mo† | 0.25-0.40 | 0.50-0.80 | 0.15-0.30 | 1.75-3.50 | 2.50-3.50 |
| Some of these steels, although following the SAE classification, are not in the present SAE list. | | | | | |
| Composition of Cast Iron, Per Cent‡ | | | | | |
| Type of Cast Iron | Total Carbon | Manganese | Phosphorus | Silicon | Chromium |
| Type 1 | 3.00-3.40 | 0.60-0.90 | Under 0.30 | 1.25-1.75 | 0.50-0.75 |
| Type 2 | 3.00-3.40 | 0.60-0.90 | Under 0.30 | 1.00-1.50 | 0.60-1.00 |
| Type 3 | 2.75-3.00 | 0.60-0.90 | Under 0.30 | 1.25-1.50 | 0.25-0.50 |
| Type 4 | 3.00-3.40 | 0.60-0.90 | Under 0.30 | 1.00-1.50 | 0.50-0.60 |
| Type 5 | 2.70-3.00 | 0.60-0.90 | Under 0.30 | 0.70-0.80 | 0.90-1.10 |
| Type 6 | 3.10-3.40 | 0.60-0.90 | Under 0.30 | 1.75-2.20 | 0.50-0.60 |
| Type 7 | 3.00-3.30 | 0.60-0.90 | Under 0.30 | 0.90-1.00 | 0.56-0.75 |
| Type 8 | 3.10-3.40 | 0.60-0.90 | Under 0.30 | 1.25-1.50 | 0.75-0.90 |

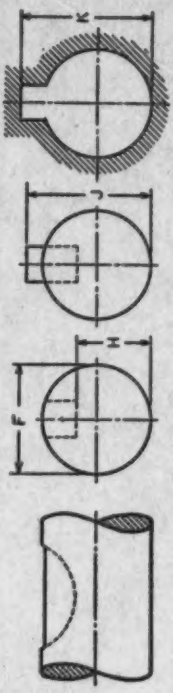
MACHINERY'S Data Sheet No. 300, New Series, June, 1935

Compiled by J. W. Sands, Development and Research Department, International Nickel Co.

114

MACHINERY'S DATA SHEETS 301 and 302

SHOP MEASUREMENTS for WOODRUFF KEYS and KEYWAYS—1



| Woodruff Key Size | Shaft Diameter | | Bottom of Keyway to Opposite Side | | Top of Key to Opposite Side | | Bottom of Keyway to Opposite Side | |
|-------------------|----------------|---------|-----------------------------------|--------|-----------------------------|--------|-----------------------------------|--------|
| | F | | H | | J | | K | |
| | Fraction | Decimal | Min. | Max. | Min. | Max. | Min. | Max. |
| 1/16 by 1/2 | 5/16 | 0.3125 | 0.1375 | 0.1425 | 0.3255 | 0.3455 | 0.2465 | 0.2515 |
| | 11/32 | 0.3437 | 0.1600 | 0.1740 | 0.3670 | 0.3770 | 0.2780 | 0.2830 |
| | 3/8 | 0.3750 | 0.2000 | 0.2050 | 0.3900 | 0.4000 | 0.3010 | 0.3060 |
| | 13/32 | 0.4062 | 0.2250 | 0.2300 | 0.4150 | 0.4250 | 0.3260 | 0.3310 |
| | 7/16 | 0.4375 | 0.2500 | 0.2550 | 0.4400 | 0.4500 | 0.3510 | 0.3560 |
| 3/32 by 1/2 | 15/32 | 0.4687 | 0.2750 | 0.2800 | 0.4600 | 0.4700 | 0.3820 | 0.3870 |
| | 1/2 | 0.5000 | 0.3000 | 0.3050 | 0.4900 | 0.5000 | 0.4030 | 0.4080 |
| | 11/32 | 0.3437 | 0.1811 | 0.1861 | 0.3791 | 0.3891 | 0.2901 | 0.2951 |
| | 3/8 | 0.3750 | 0.2129 | 0.2179 | 0.4109 | 0.4209 | 0.3219 | 0.3269 |
| | 13/32 | 0.4062 | 0.2378 | 0.2428 | 0.4458 | 0.4558 | 0.3568 | 0.3618 |
| 1/8 by 1/2 | 1/2 | 0.5000 | 0.3000 | 0.3050 | 0.4900 | 0.5000 | 0.4030 | 0.4080 |
| | 11/32 | 0.3437 | 0.1811 | 0.1861 | 0.3791 | 0.3891 | 0.2901 | 0.2951 |
| | 3/8 | 0.3750 | 0.2129 | 0.2179 | 0.4109 | 0.4209 | 0.3219 | 0.3269 |
| | 13/32 | 0.4062 | 0.2378 | 0.2428 | 0.4458 | 0.4558 | 0.3568 | 0.3618 |
| | 7/16 | 0.4375 | 0.2500 | 0.2550 | 0.4700 | 0.4800 | 0.3810 | 0.3860 |
| 5/32 by 5/8 | 1/2 | 0.5000 | 0.3000 | 0.3050 | 0.4900 | 0.5000 | 0.4030 | 0.4080 |
| | 11/32 | 0.3437 | 0.1811 | 0.1861 | 0.3791 | 0.3891 | 0.2901 | 0.2951 |
| | 3/8 | 0.3750 | 0.2129 | 0.2179 | 0.4109 | 0.4209 | 0.3219 | 0.3269 |
| | 13/32 | 0.4062 | 0.2378 | 0.2428 | 0.4458 | 0.4558 | 0.3568 | 0.3618 |
| | 7/16 | 0.4375 | 0.2500 | 0.2550 | 0.4700 | 0.4800 | 0.3810 | 0.3860 |

MACHINERY'S Data Sheet No. 301, New Series, July, 1935

Based upon SAE Handbook. Copyrighted by the Society of Automotive Engineers, Inc.

SHOP MEASUREMENTS for WOODRUFF KEYS and KEYWAYS—2

| Woodruff Key Size | Shaft Diameter | | Bottom of Keyway to Opposite Side | | Top of Key to Opposite Side | | Bottom of Keyway to Opposite Side | |
|-------------------|----------------|---------|-----------------------------------|--------|-----------------------------|--------|-----------------------------------|--------|
| | F | | H | | J | | K | |
| | Fraction | Decimal | Min. | Max. | Min. | Max. | Min. | Max. |
| 5/32 by 5/8 | 15/32 | 0.4687 | 0.2834 | 0.2884 | 0.5284 | 0.5384 | 0.5444 | 0.5494 |
| | 1/2 | 0.5000 | 0.3166 | 0.3216 | 0.5606 | 0.5706 | 0.5766 | 0.5816 |
| | 9/16 | 0.5625 | 0.3750 | 0.3800 | 0.6225 | 0.6325 | 0.6385 | 0.6435 |
| | 5/8 | 0.6250 | 0.4375 | 0.4425 | 0.6850 | 0.6950 | 0.7010 | 0.7060 |
| | 11/16 | 0.6875 | 0.5000 | 0.5050 | 0.7475 | 0.7575 | 0.7635 | 0.7685 |
| 1/8 by 3/4 | 3/4 | 0.7500 | 0.5625 | 0.5675 | 0.8125 | 0.8225 | 0.8285 | 0.8335 |
| | 13/16 | 0.8125 | 0.6250 | 0.6300 | 0.8750 | 0.8850 | 0.8910 | 0.8960 |
| | 7/8 | 0.8750 | 0.6875 | 0.6925 | 0.9375 | 0.9475 | 0.9535 | 0.9585 |
| | 15/16 | 0.9375 | 0.7500 | 0.7550 | 1.0000 | 1.0100 | 1.0160 | 1.0210 |
| | 1 | 1.0000 | 0.8125 | 0.8175 | 1.0625 | 1.0725 | 1.0785 | 1.0835 |
| 5/32 by 3/4 | 1/2 | 0.5000 | 0.2416 | 0.2466 | 0.5406 | 0.5506 | 0.5566 | 0.5616 |
| | 9/16 | 0.5625 | 0.3042 | 0.3092 | 0.6032 | 0.6132 | 0.6192 | 0.6242 |
| | 5/8 | 0.6250 | 0.3668 | 0.3718 | 0.6658 | 0.6758 | 0.6818 | 0.6868 |
| | 11/16 | 0.6875 | 0.4294 | 0.4344 | 0.7284 | 0.7384 | 0.7444 | 0.7494 |
| | 3/4 | 0.7500 | 0.4920 | 0.4970 | 0.7910 | 0.8010 | 0.8070 | 0.8120 |
| 3/16 by 1/2 | 1/2 | 0.5000 | 0.2416 | 0.2466 | 0.5406 | 0.5506 | 0.5566 | 0.5616 |
| | 9/16 | 0.5625 | 0.3042 | 0.3092 | 0.6032 | 0.6132 | 0.6192 | 0.6242 |
| | 5/8 | 0.6250 | 0.3668 | 0.3718 | 0.6658 | 0.6758 | 0.6818 | 0.6868 |
| | 11/16 | 0.6875 | 0.4294 | 0.4344 | 0.7284 | 0.7384 | 0.7444 | 0.7494 |
| | 3/4 | 0.7500 | 0.4920 | 0.4970 | 0.7910 | 0.8010 | 0.8070 | 0.8120 |

MACHINERY'S Data Sheet No. 302, New Series, July, 1935

Based upon SAE Handbook. Copyrighted by the Society of Automotive Engineers, Inc.

MACHINERY'S DATA SHEETS 303 and 304

SHOP MEASUREMENTS for WOODRUFF KEYS and KEYWAYS—3

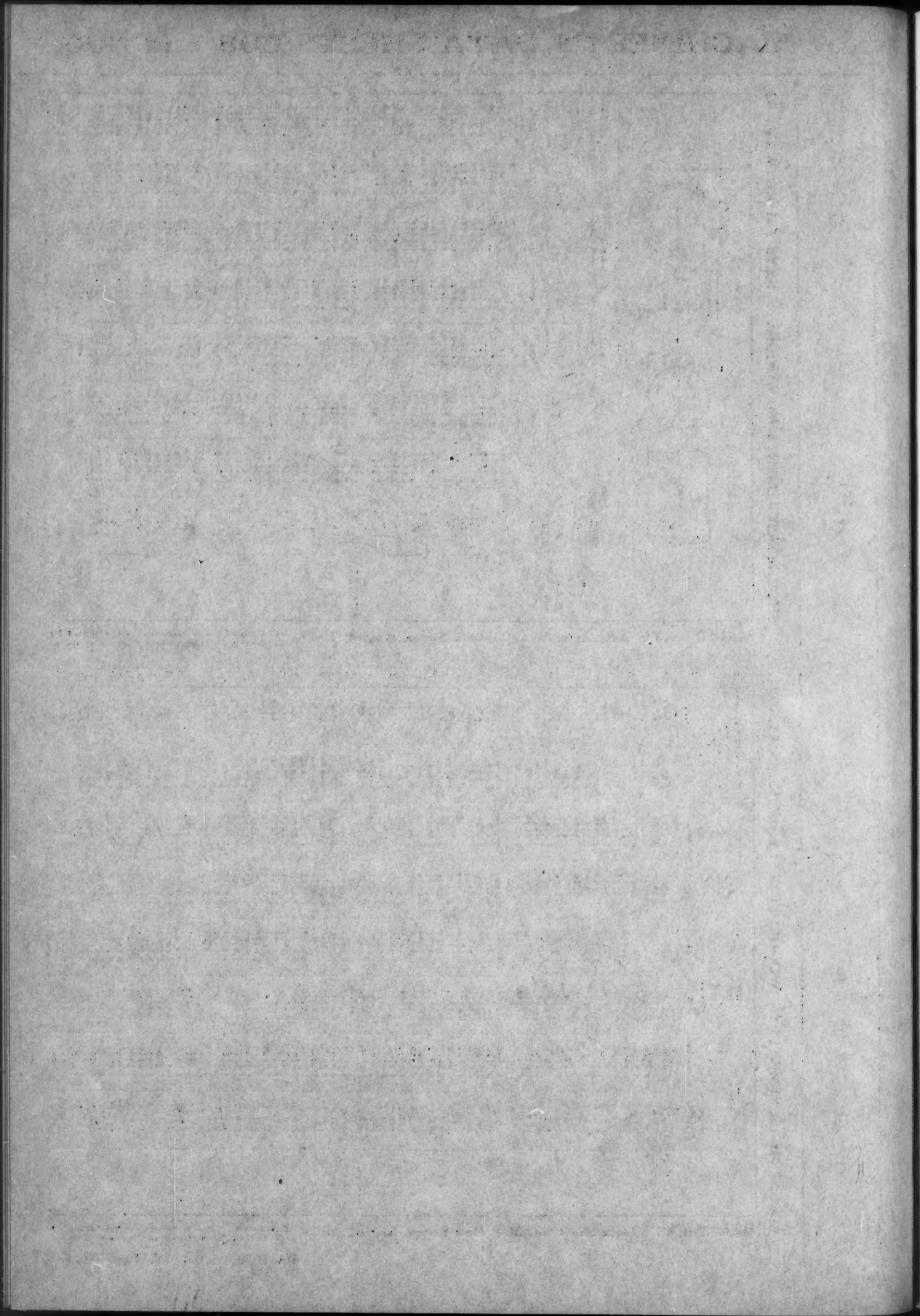
| Woodruff Key Size | Shaft Diameter F | | Bottom of Keyseat to Opposite Side H | | Top of Key to Opposite Side J | | Bottom of Keyway to Opposite Side K | |
|-------------------|------------------|---------|--------------------------------------|--------|-------------------------------|--------|-------------------------------------|--------|
| | Fraction | Decimal | Min. | Max. | Min. | Max. | Min. | Max. |
| | | | | | | | | |
| 5/16 by 7/8 | 5/8 | 0.6250 | 0.3182 | 0.3232 | 0.6882 | 0.6932 | 0.6992 | 0.7042 |
| | 11/16 | 0.6875 | 0.3816 | 0.3866 | 0.7516 | 0.7566 | 0.7576 | 0.7626 |
| | 3/4 | 0.7500 | 0.4450 | 0.4499 | 0.8149 | 0.8199 | 0.8209 | 0.8259 |
| | 7/8 | 0.8750 | 0.5080 | 0.5130 | 0.9280 | 0.9330 | 0.9340 | 0.9390 |
| | 1 1/8 | 1.1250 | 0.6410 | 0.6460 | 1.0410 | 1.0460 | 1.0470 | 1.0520 |
| | 1 1/4 | 1.2500 | 0.7040 | 0.7090 | 1.1040 | 1.1090 | 1.1100 | 1.1150 |
| | 1 3/8 | 1.3750 | 0.7670 | 0.7720 | 1.1670 | 1.1720 | 1.1730 | 1.1780 |
| | 1 1/2 | 1.5000 | 0.8300 | 0.8350 | 1.2300 | 1.2350 | 1.2360 | 1.2410 |
| | 1 5/8 | 1.6250 | 0.8930 | 0.8980 | 1.2930 | 1.2980 | 1.2990 | 1.3040 |
| | 1 3/4 | 1.7500 | 0.9560 | 0.9610 | 1.3560 | 1.3610 | 1.3620 | 1.3670 |
| 3/16 by 7/8 | 5/8 | 0.6250 | 0.3232 | 0.3282 | 0.6932 | 0.6982 | 0.7032 | 0.7082 |
| | 11/16 | 0.6875 | 0.3866 | 0.3916 | 0.7566 | 0.7616 | 0.7666 | 0.7716 |
| | 3/4 | 0.7500 | 0.4499 | 0.4549 | 0.8199 | 0.8249 | 0.8299 | 0.8349 |
| | 7/8 | 0.8750 | 0.5130 | 0.5180 | 0.8830 | 0.8880 | 0.8930 | 0.8980 |
| | 1 1/8 | 1.1250 | 0.6460 | 0.6510 | 1.0460 | 1.0510 | 1.0520 | 1.0570 |
| | 1 1/4 | 1.2500 | 0.7090 | 0.7140 | 1.1090 | 1.1140 | 1.1150 | 1.1200 |
| | 1 3/8 | 1.3750 | 0.7720 | 0.7770 | 1.1720 | 1.1770 | 1.1780 | 1.1830 |
| | 1 1/2 | 1.5000 | 0.8350 | 0.8400 | 1.2350 | 1.2400 | 1.2410 | 1.2460 |
| | 1 5/8 | 1.6250 | 0.8980 | 0.9030 | 1.2980 | 1.3030 | 1.3040 | 1.3090 |
| | 1 3/4 | 1.7500 | 0.9610 | 0.9660 | 1.3610 | 1.3660 | 1.3670 | 1.3720 |
| 1/4 by 7/8 | 5/8 | 0.6250 | 0.3282 | 0.3332 | 0.6982 | 0.7032 | 0.7082 | 0.7132 |
| | 11/16 | 0.6875 | 0.3916 | 0.3966 | 0.7616 | 0.7666 | 0.7716 | 0.7766 |
| | 3/4 | 0.7500 | 0.4549 | 0.4599 | 0.8249 | 0.8299 | 0.8349 | 0.8399 |
| | 7/8 | 0.8750 | 0.5180 | 0.5230 | 0.8880 | 0.8930 | 0.8980 | 0.9030 |
| | 1 1/8 | 1.1250 | 0.6510 | 0.6560 | 1.0510 | 1.0560 | 1.0570 | 1.0620 |
| | 1 1/4 | 1.2500 | 0.7140 | 0.7190 | 1.1140 | 1.1190 | 1.1200 | 1.1250 |
| | 1 3/8 | 1.3750 | 0.7770 | 0.7820 | 1.1770 | 1.1820 | 1.1830 | 1.1880 |
| | 1 1/2 | 1.5000 | 0.8400 | 0.8450 | 1.2400 | 1.2450 | 1.2460 | 1.2510 |
| | 1 5/8 | 1.6250 | 0.9030 | 0.9080 | 1.3030 | 1.3080 | 1.3090 | 1.3140 |
| | 1 3/4 | 1.7500 | 0.9660 | 0.9710 | 1.3660 | 1.3710 | 1.3720 | 1.3770 |

MACHINERY'S Data Sheet No. 303, New Series, August, 1935 Based upon SAE Handbook. Copyrighted by the Society of Automotive Engineers, Inc.

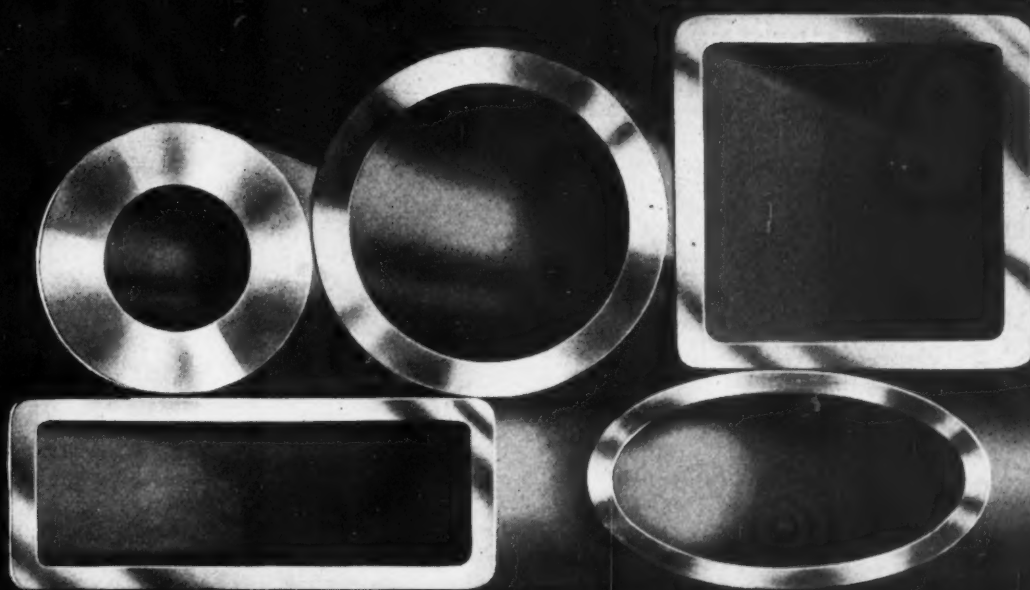
SHOP MEASUREMENTS for WOODRUFF KEYS and KEYWAYS—4

| Woodruff Key Size | Shaft Diameter F | | Bottom of Keyseat to Opposite Side H | | Top of Key to Opposite Side J | | Bottom of Keyway to Opposite Side K | |
|-------------------|------------------|---------|--------------------------------------|--------|-------------------------------|--------|-------------------------------------|--------|
| | Fraction | Decimal | Min. | Max. | Min. | Max. | Min. | Max. |
| | | | | | | | | |
| 5/16 by 1 | 11/16 | 0.6875 | 0.3302 | 0.3352 | 0.7332 | 0.7382 | 0.7432 | 0.7482 |
| | 3/4 | 0.7500 | 0.3936 | 0.3986 | 0.7966 | 0.8016 | 0.8066 | 0.8116 |
| | 7/8 | 0.8750 | 0.4570 | 0.4620 | 0.8600 | 0.8650 | 0.8700 | 0.8750 |
| | 1 1/8 | 1.1250 | 0.5900 | 0.5950 | 1.0030 | 1.0080 | 1.0130 | 1.0180 |
| | 1 1/4 | 1.2500 | 0.6530 | 0.6580 | 1.0660 | 1.0710 | 1.0760 | 1.0810 |
| | 1 3/8 | 1.3750 | 0.7160 | 0.7210 | 1.1290 | 1.1340 | 1.1390 | 1.1440 |
| | 1 1/2 | 1.5000 | 0.7790 | 0.7840 | 1.1920 | 1.1970 | 1.2020 | 1.2070 |
| | 1 5/8 | 1.6250 | 0.8420 | 0.8470 | 1.2550 | 1.2600 | 1.2650 | 1.2700 |
| | 1 3/4 | 1.7500 | 0.9050 | 0.9100 | 1.3180 | 1.3230 | 1.3280 | 1.3330 |
| | 2 | 2.0000 | 1.0380 | 1.0430 | 1.4510 | 1.4560 | 1.4610 | 1.4660 |
| 1/4 by 1 | 3/4 | 0.7500 | 0.4156 | 0.4206 | 0.8186 | 0.8236 | 0.8286 | 0.8336 |
| | 7/8 | 0.8750 | 0.4790 | 0.4840 | 0.8820 | 0.8870 | 0.8920 | 0.8970 |
| | 1 1/8 | 1.1250 | 0.6120 | 0.6170 | 1.0150 | 1.0200 | 1.0250 | 1.0300 |
| | 1 1/4 | 1.2500 | 0.6750 | 0.6800 | 1.0780 | 1.0830 | 1.0880 | 1.0930 |
| | 1 3/8 | 1.3750 | 0.7380 | 0.7430 | 1.1410 | 1.1460 | 1.1510 | 1.1560 |
| | 1 1/2 | 1.5000 | 0.8010 | 0.8060 | 1.2040 | 1.2090 | 1.2140 | 1.2190 |
| | 1 5/8 | 1.6250 | 0.8640 | 0.8690 | 1.2670 | 1.2720 | 1.2770 | 1.2820 |
| | 1 3/4 | 1.7500 | 0.9270 | 0.9320 | 1.3300 | 1.3350 | 1.3400 | 1.3450 |
| | 2 | 2.0000 | 1.0600 | 1.0650 | 1.4630 | 1.4680 | 1.4730 | 1.4780 |
| | 2 1/2 | 2.5000 | 1.2930 | 1.2980 | 1.6960 | 1.7010 | 1.7060 | 1.7110 |
| 5/16 by 1 | 3/4 | 0.7500 | 0.4341 | 0.4391 | 0.8371 | 0.8421 | 0.8471 | 0.8521 |
| | 7/8 | 0.8750 | 0.4975 | 0.5025 | 0.9005 | 0.9055 | 0.9105 | 0.9155 |
| | 1 1/8 | 1.1250 | 0.6305 | 0.6355 | 1.0335 | 1.0385 | 1.0435 | 1.0485 |
| | 1 1/4 | 1.2500 | 0.6935 | 0.6985 | 1.0965 | 1.1015 | 1.1065 | 1.1115 |
| | 1 3/8 | 1.3750 | 0.7565 | 0.7615 | 1.1595 | 1.1645 | 1.1695 | 1.1745 |
| | 1 1/2 | 1.5000 | 0.8195 | 0.8245 | 1.2225 | 1.2275 | 1.2325 | 1.2375 |
| | 1 5/8 | 1.6250 | 0.8825 | 0.8875 | 1.2855 | 1.2905 | 1.2955 | 1.3005 |
| | 1 3/4 | 1.7500 | 0.9455 | 0.9505 | 1.3485 | 1.3535 | 1.3585 | 1.3635 |
| | 2 | 2.0000 | 1.0785 | 1.0835 | 1.4815 | 1.4865 | 1.4915 | 1.4965 |
| | 2 1/2 | 2.5000 | 1.3115 | 1.3165 | 1.7145 | 1.7195 | 1.7245 | 1.7295 |
| 3/16 by 1 1/8 | 3/4 | 0.7500 | 0.4531 | 0.4581 | 0.8561 | 0.8611 | 0.8661 | 0.8711 |
| | 7/8 | 0.8750 | 0.5165 | 0.5215 | 0.9195 | 0.9245 | 0.9295 | 0.9345 |
| | 1 1/8 | 1.1250 | 0.6495 | 0.6545 | 1.0525 | 1.0575 | 1.0625 | 1.0675 |
| | 1 1/4 | 1.2500 | 0.7125 | 0.7175 | 1.1155 | 1.1205 | 1.1255 | 1.1305 |
| | 1 3/8 | 1.3750 | 0.7755 | 0.7805 | 1.1785 | 1.1835 | 1.1885 | 1.1935 |
| | 1 1/2 | 1.5000 | 0.8385 | 0.8435 | 1.2415 | 1.2465 | 1.2515 | 1.2565 |
| | 1 5/8 | 1.6250 | 0.9015 | 0.9065 | 1.3045 | 1.3095 | 1.3145 | 1.3195 |
| | 1 3/4 | 1.7500 | 0.9645 | 0.9695 | 1.3675 | 1.3725 | 1.3775 | 1.3825 |
| | 2 | 2.0000 | 1.0975 | 1.1025 | 1.5005 | 1.5055 | 1.5105 | 1.5155 |
| | 2 1/2 | 2.5000 | 1.3305 | 1.3355 | 1.7335 | 1.7385 | 1.7435 | 1.7485 |

MACHINERY'S Data Sheet No. 304, New Series, August, 1935 Based upon SAE Handbook. Copyrighted by the Society of Automotive Engineers, Inc.



3 GOOD REASONS



- 1 MACHINING OPERATIONS ARE MINIMIZED**
- 2 LABOR IS ECONOMIZED**
- 3 WEAR ON TOOLS IS REDUCED**

Use NATIONAL-SHELBY Seamless Tubing for making modern-day parts and you will be up-to-the-minute in efficient manufacturing and cost-saving. Just a single cut or light grinding may be all that is needed to make your part, or perhaps simple swaging, expanding, or upsetting, either from hot-finished or cold-drawn tubing. The finished part will be of fine, uniform steel structure with exceptional strength and no excess weight. Available in practically any size and wall-thickness and in various shapes. Grades and treatments of steel are furnished to meet almost any use. Send for Seamless Handbook.

NATIONAL TUBE COMPANY • Pittsburgh, Pa.

Pacific Coast Distributors—COLUMBIA STEEL CO., San Francisco, Calif.
Expert Distributors—UNITED STATES STEEL PRODUCTS CO., New York, N. Y.

United States Steel  *Corporation Subsidiary*

*Some things you
can do with
NATIONAL-
SHELBY
Seamless Tubing*

TWIST IT
WELD IT
THREAD IT
MACHINE IT
GRIND IT
SWAGE IT
COAT IT
BEND IT
COIL IT
UPSET IT
TEMPER IT
FLANGE IT
EXPAND IT
FLATTEN IT

SEAMLESS MECHANICAL TUBING

Save money on machining flat surfaces

Get
the Blanchard Story
from the representative
nearest you:—

DOMESTIC

Henry Prentiss & Company, Inc.

*New York, Boston, Buffalo, Hartford,
Rochester and Syracuse*

Motch & Merryweather Machinery Co.
Cleveland, Cincinnati, Detroit and Pittsburgh

Marshall & Huschart Machinery Co., *Chicago*

W. E. Shipley Machinery Co., *Philadelphia*

Marshall & Huschart Machinery Co. of
Indiana Indianapolis

Elliott & Stephens Machinery Co., *St. Louis*

Kemp Machinery Co., *Baltimore*

Robinson, Cary & Sands Co.,
St. Paul and Duluth

Hendrie & Bolthoff Manufacturing & Supply
Co., *Denver*

Harron, Rickard & McCone Co.,
San Francisco and Los Angeles

Woodward Wight & Co., Ltd., *New Orleans*

Sam H. Penny, *Houston*

Tidewater Supply Co., *Norfolk*

Star Machinery Co., *Seattle*

FOREIGN

Williams & Wilson, *Montreal*

F. F. Barber Machinery Co., *Toronto*

Burton, Griffiths & Co., *Birmingham*

Aux Forges de Vulcain, *Paris*

Andrews & George Co., *Tokyo*

Benson Brothers, *Sydney*

Maskinaktiebolaget Karlebo, *Stockholm*

Ing M. Kocian & G. Nedela, *Prague*

D. Drury & Co., Ltd., *Johannesburg*

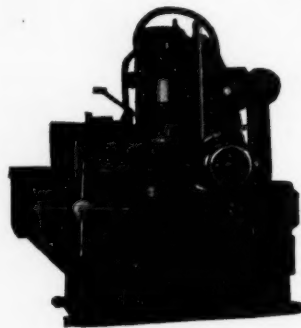
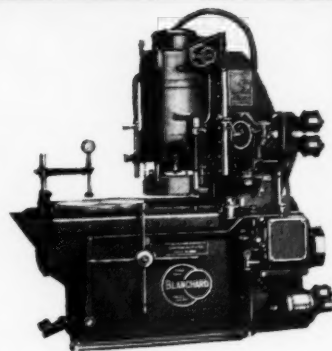
C. Schinz & Co., *Zurich*

R. S. Stokvis & Sons, *Rotterdam and Brussels*

Emanuele Mascherpa, *Milan*

No. 16

Applicable to a
wide range of
production work
and also to die
and tool work.

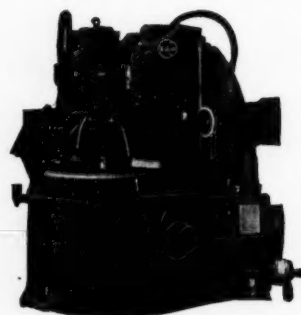
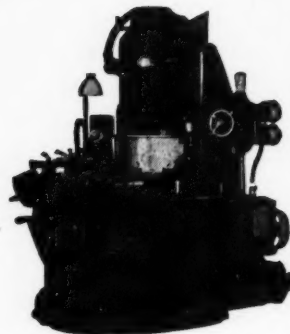


No. 10

Especially suited
to tool rooms and
where production
does not warrant
a larger machine.

No. 16-A

Automatic Sizing;
operator only
loads work; for
high production
and uniform ac-
curacy on small
parts.

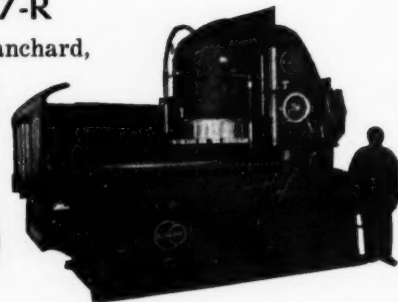


No. 16-A2

Two Spindles,
one roughing and
one finishing,
each with Auto-
matic Sizing.

No. 27-R

The largest Blanchard,
capacity up to
96 in. diam-
eter.

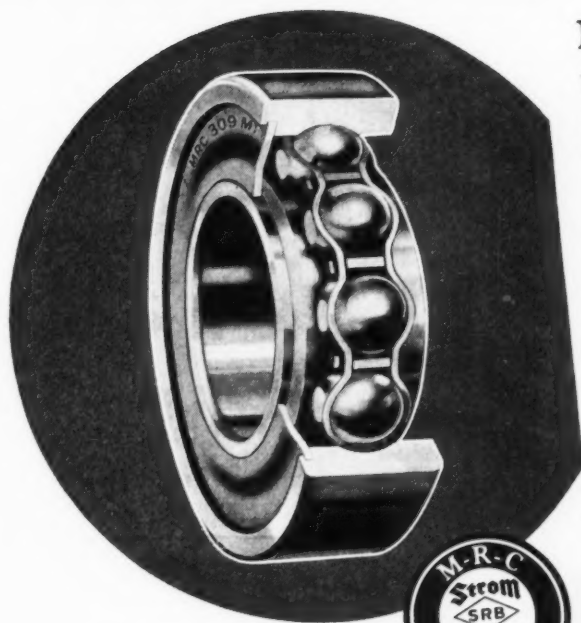


THE BLANCHARD MACHINE COMPANY
64 STATE STREET **CAMBRIDGE, MASS.**

WHAT DOES

M-R-C

MEAN TO YOU?



Leadership

M-R-C represents the combined prestige of three pioneer manufacturers—Gurney—SRB—Strom. Twenty-three bearing types . . . a design for every possible speed, load and operating condition . . . has a distinct appeal to the designing engineer. With all types available from M-R-C and listed in the M-R-C catalog, the problem of bearing selection—design comparison—sealing—housing—and lubricating is greatly simplified.

23 TYPES of individually famous ball bearings under one name.

MARLIN-ROCKWELL CORPORATION

EXECUTIVE OFFICES IN JAMESTOWN, N. Y.

FACTORIES — JAMESTOWN — PLAINVILLE, CONN. — CHICAGO

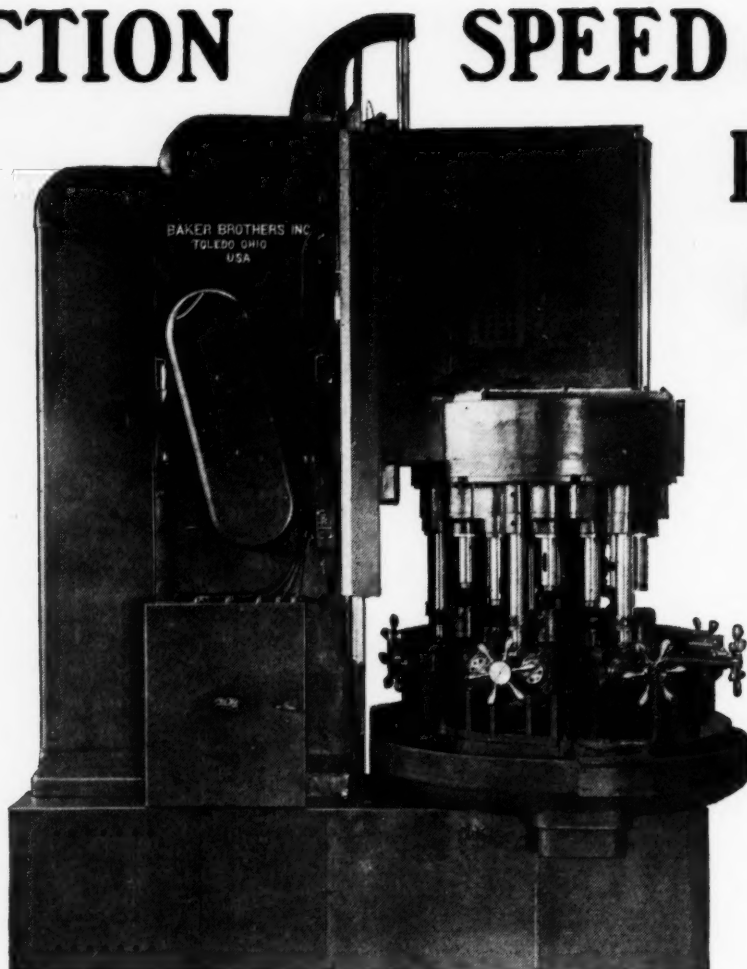
MACHINERY, August, 1935—65

PRODUCTION

SPEED *with the*

BAKER

60 VH



**The Baker Contour
Grinder**

This inexpensive machine can pay its way in almost any tool or die shop. It will pay you to investigate. Write attention Dept. M.

● This machine is another Baker designed to meet production requirements of accuracy with faster production and with lower cost.

The 60VH performs three operations on connecting rods entirely automatically except for loading and unloading. Handling the parts in pairs, holes in both ends are drilled, straightened and finish-reamed. The hydraulic feed and automatic indexing table produce finished pieces with a minimum of time and handling.

Baker machines have lowered costs and production time for many manufacturers. We would like to check your problems. Before you figure the costs of a part as final, see if a Baker machine can't lower them. An inquiry with blue prints or sample part will have our prompt attention.

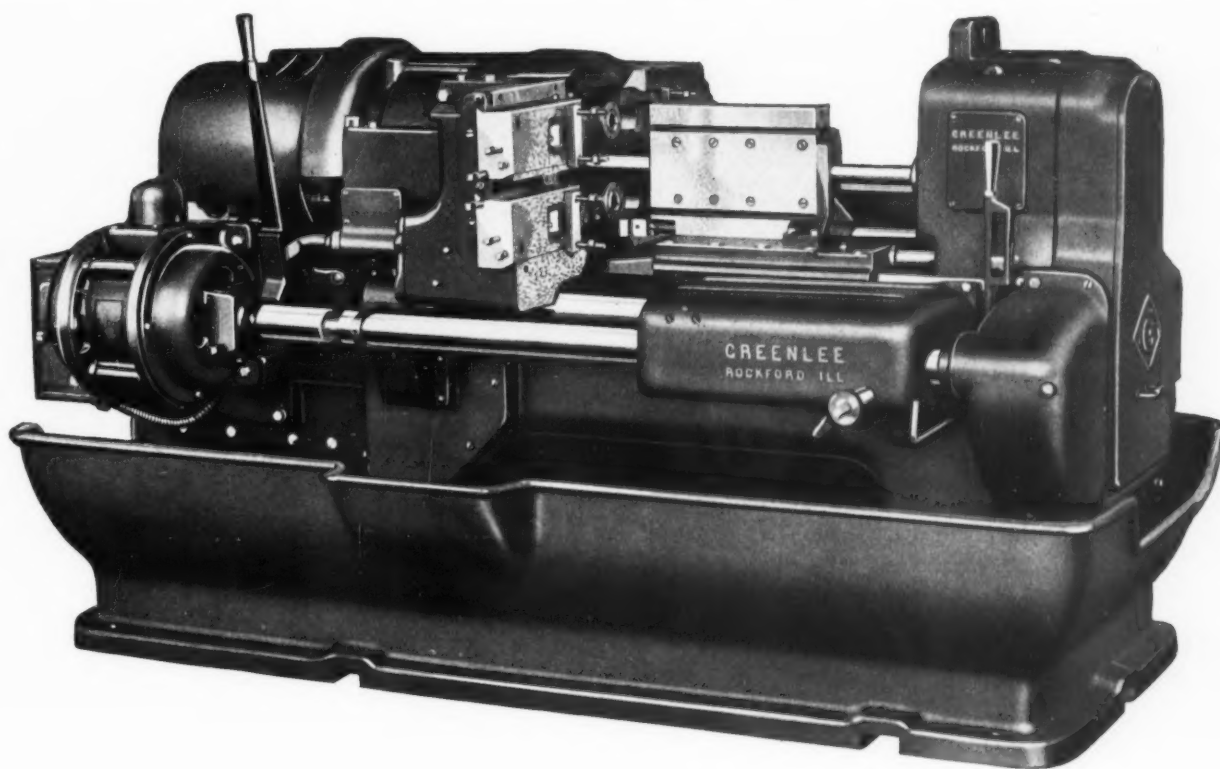
M¹⁹³⁵ACHINE

CLEVELAND
SEPT. 11-21
TOOL
SHOW

**SEE US AT
BOOTH
307-B**

BAKER BROS., INC., TOLEDO, OHIO, U. S. A.

★ BAKER ★



STUDY THE GREENLEE WHEN YOU CONSIDER YOUR SCREW MACHINE PROBLEMS



Ask for Your Copy Now!

This 16-page bulletin not only illustrates and describes many of the original Greenlee features built into this line of Four-Spindle Automatics, but it also explains their advantages and shows several set-ups where important savings were made as a result of them. Sending for it is the first step in becoming familiar with Greenlee Screw Machines. No obligation, of course.

IT MAY be a problem of production, of accuracy, of replacing worn-out machines; or it may involve the matter of putting in a screw machine department for the first time. But whatever the problem is, you will want to study the Greenlee to see if the solution is not to be found there.

Greenlee Four-Spindle Automatics have much to recommend them for the ability to meet modern production requirements, whether they involve continuous operation on one job or frequent changes in set-up for general screw products work. They are easy to get at, and they are of unusually sturdy construction.

Take the main tool slide for example: It is built like an inverted T, which provides for the use of tool holders having broad, flat clamping surfaces with tongues to fit the slots in the slide. There is a T-slot for each spindle position, and an additional one is milled in the top surface, making five slots for attaching tool holders.

This arrangement of slots makes possible the splitting up of long operations and the grouping of several in one position, all of which reduces the production time on many jobs.



Multiple-Spindle Drilling,
Boring, and Tapping
Machines



Four-Spindle Automatics,
Special Machinery for
Many Purposes



MADE IN ROCKFORD, ILLINOIS, U. S. A.

Rigid Support for Spindle Assembly Prevents Wheel Drop . . .



MATTISON
HIGH-POWERED
PRECISION SURFACE GRINDER

FAST, accurate grinding of parts of irregular surface, such as illustrated by this spindle-bearing plate, is a difficult job for the ordinary surface grinder.

With the Mattison Surface Grinder, its extremely rigid construction throughout the wheel-spindle-assembly supporting unit—double column mounting—extra heavy gibs and slides—high power—insures a true-running wheel that will carry through the cut regardless of change in grinding resistance.

Therefore, the Mattison High-Powered Precision Surface Grinder consistently produces uniformly flat surfaces within extremely close limits of accuracy.

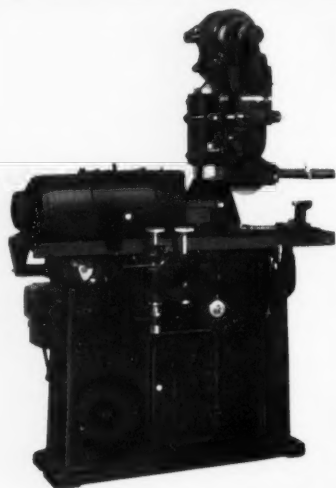
Precision Grinding at Roughing Speeds

Above set-up shows Mattison Surface Grinder grinding 17" wide, 50" long, 1 1/4" thick spindle-bearing plate. Material: Machine steel. Grinding requirement: Remove .020" stock from each side, hold parallel and flat to plus or minus .0005".

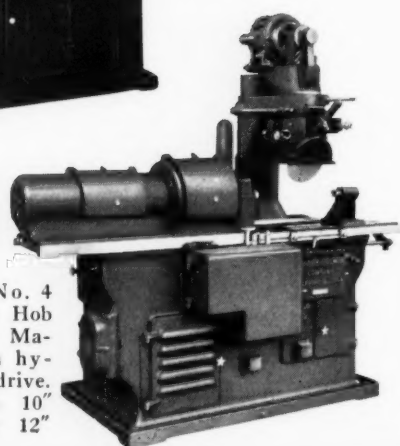
Submit Samples or Blue Prints of Work—Let us Furnish Production Reports

MATTISON MACHINE WORKS—ROCKFORD, ILLINOIS

Sharp Hobs Increase Profits



At left, No. 3 Automatic Hob Sharpening Machine with mechanical table drive. Capacity to 4" diameter by 4" face.



At right, No. 4 Automatic Hob Sharpening Machine with hydraulic table drive. Capacity to 10" diameter by 12" face.

Sharp hobs maintain high production, high quality and accuracy of surfaces hobbled, reduce operating costs, increase profits. To secure these advantages, hobs must be sharpened *correctly* and *kept* that way. Sharpening hobs of any make is easy on the Barber-Colman Automatic Hob Sharpening Machines shown at left. Set-up is simple, indexing accurate, feed rate and depth of grind positively controlled. A few simple adjustments prepare the machines for sharpening straight- or helical-gashed hobs, or formed cutters, with radial tooth-faces or rake. Uniformly accurate sharpening then proceeds automatically so that one operator can run other machines also if desired. Manufacturers running any quantity of hobs or formed cutters are invited to investigate Barber-Colman Hob Sharpening and to write for circulars describing our Hob Sharpening Machines.

In addition to the machines shown, Barber-Colman complete hobbing service includes Standard and Special Hobs with unground or ground tooth-forms, Hobbing Machines in several sizes and types, consulting engineering and inspection of hobbing equipment made by us which is rendered on request without charge, or obligation on your part.

BARBER
B-C
COLMAN
PRODUCTS

MILLING CUTTERS,
HOBS, HOBGING
MACHINES, HOB
SHARPENING MA-
CHINES, REAMERS,
REAMER SHARP-
ENING MACHINES,
SPECIAL TOOLS

BARBER-COLMAN COMPANY

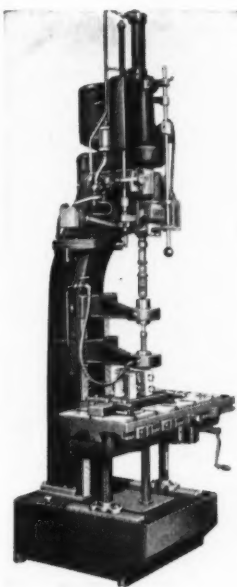
General Offices and Plant ROCKFORD, ILLINOIS, U. S. A.

MADE IN ROCKFORD, ILLINOIS, U. S. A.

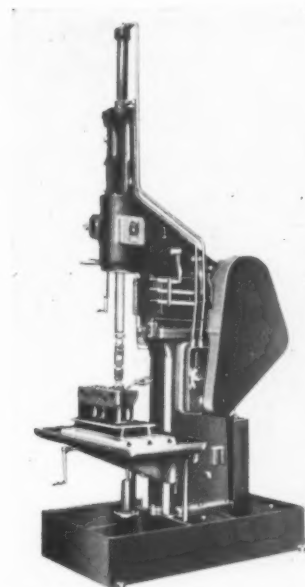
Machinery—August, 1935

SELF-OILING, ALL-GEARED

Internal Honing Gives You 3 Profits



Above—No. 194 Honer, with patented electric stroke counter. Unexcelled for finishing bores from $\frac{3}{8}$ " to 4" diameter, and for lapping smaller holes.



Above—No. 249 Single-Spindle Honer with quick-change speeds. Has 16" stroke, hones to 8" diameter.

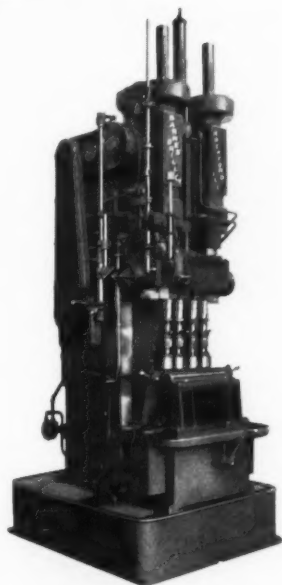
ACCURACY—Self-Oiling, All-Geared Internal Honing gives you a higher degree of accuracy than can be obtained by any other method, and at lower cost. Holes are truly round, straight from end to end without "bell mouth" or "barrel," accurate in size within .0002" on the smaller diameters and .001" on the largest.

PRODUCTION—This method gives you higher production in less floor space with a smaller number of operators than other methods of bore finishing.

FINE FINISH—The surface created by Internal Honing is either satin smooth or like a mirror, as desired. It saves running-in time, improves quality and operation of the product in which it is used, adds powerful selling features.

Self-Oiling, All-Geared Honing gives you three profits—greater accuracy at low cost, increased production in small space, a finer product with added selling features. Investigate!

Below—No. 214 Multiple Spindle Honer for finishing 2 to 8 cylinders simultaneously.



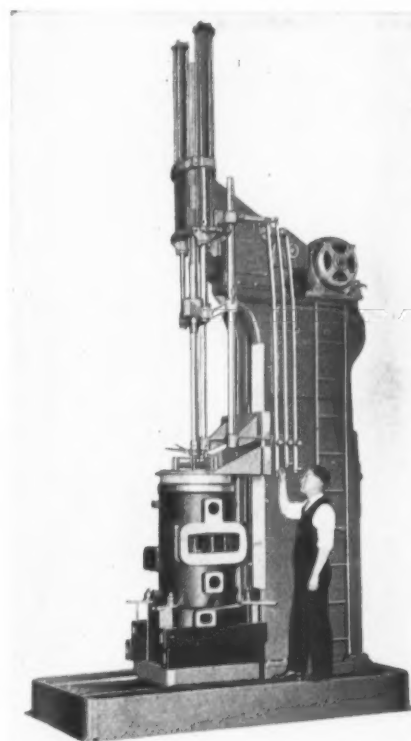
At right—No. 3620 Honer for finishing large Diesel engine and other cylinders up to 20" dia. by 54" long.

SEND FOR BOOKLET—Our illustrated booklet entitled "The Honing Process" contains much valuable information. Write for a copy today. Address department M.

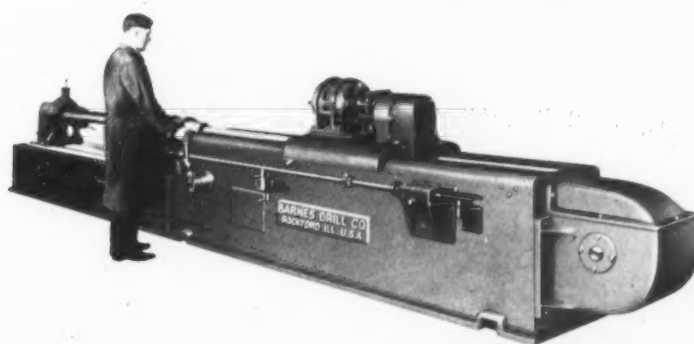
BARNES DRILL CO.

814 Chestnut St.,

Rockford, Illinois



At right—No. 5 Horizontal Honer, for reducing cost of finishing bores that have hitherto been difficult to machine to desired accuracy. Also available in two larger sizes.

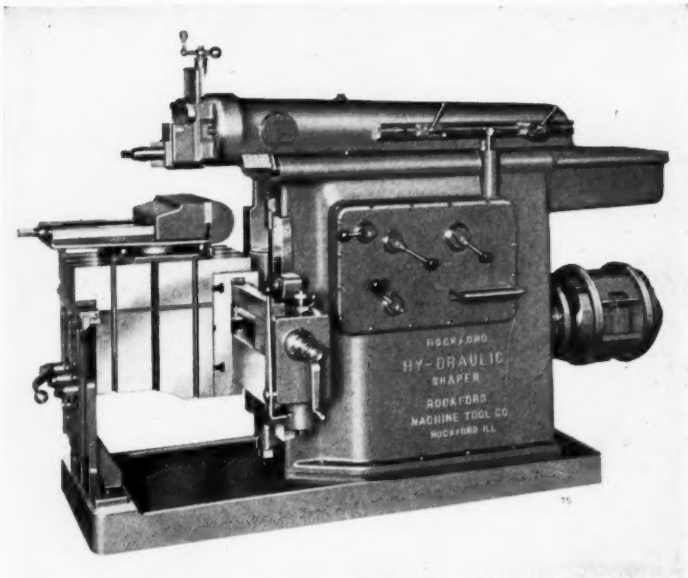


MADE IN ROCKFORD, ILLINOIS, U. S. A.

Machinery—August, 1935

The HY-DRAULIC SHAPER

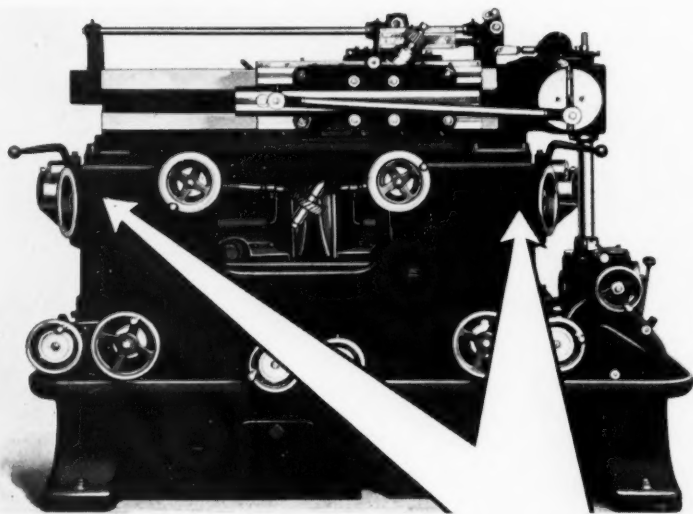
Before placing his order, anyone who is thinking about buying one or more new shapers ought to be thoroughly familiar with the outstanding advantages of the Rockford Hy-Draulic Shaper. In addition to being an accurate, powerful, durable, well-designed machine-tool; this is the only shaper of its kind on the market. It has *hydraulic ram drive, hydraulic feeds and rapid traverses, independent hand adjustment of the table*. To appreciate what this means in the way of increased efficiency, output and economy; compare the Rockford Hy-Draulic with any mechanical-drive shaper on the market, including our own. Such a comparison is made in our folder on the Rockford Hy-Draulic Shaper which we are glad to send to interested executives promptly on request. Write for a copy today.



ROCKFORD MACHINE TOOL CO.
 LATHES SHAPERS SHAPER-PLANERS
 ROCKFORD, ILLINOIS, U. S. A.

PULLMORE CLUTCHES USED IN

Lees-Bradner Gear Grinders



Pullmore Clutches are made in single and double types, for operation in oil or dry, in capacities ranging from 1 H. P. to 60 H. P.

O-C Toggle-type Disc Clutches

For heavier duty service with gasoline or Diesel engine power units we also make the Rockford O-C toggle type disc clutch in sizes ranging from 6" to 20" diameter, with single or double drive plates.



SINGLE-TYPE PULLMORE CLUTCH.



DOUBLE-TYPE PULLMORE CLUTCH.

Two No. 2 Single-type Pullmore Clutches running in oil control rotation of the two large-diameter grinding wheels in the Lees-Bradner Grinder, for spur and helical gears, shown at left. Each grinding wheel is mounted on a slide with its own driving motor to form a neat, powerful, compact unit. The Pullmore Clutch is ideal for just such applications because it is adaptable, powerful, compact, reliable, and durable. Pullmore Clutches are used in a variety of other machine-tools and have been adopted as standard by leading manufacturers of:—

| | |
|------------------------|--------------------------|
| Welding Machines | Pipe Threading Machines |
| Road Working Equipment | Testing Machinery |
| Cranes | Rubber Working Machinery |
| Wire Spooling Machines | Printing Machinery |
| Book Binding Machinery | Fire Fighting Equipment |
| | Industrial Trucks |

Note range of sizes, and types shown at left. Write today for additional information and prices.

ROCKFORD DRILLING MACHINE CO.
 310 Catherine Street, Rockford, Illinois

Sold by MORSE CHAIN CO., Ithaca, N. Y.
 With offices in principal cities

MADE IN ROCKFORD, ILLINOIS, U. S. A.



ENGINEERED PRODUCTION

EXAMPLES FROM THE SUNDSTRAND FILES

No. 3517

Lathes
Milling Machines
Tool Grinders
Centering Machines
Balancing Tools

Sundstrand Cracks A Tough Nut

Occasionally almost every machine-tool manufacturer encounters a "tough nut" that does not yield to ordinary methods of treatment. Such a piece of work is shown in Fig. 1. These are forgings for the cross piece in an oil well



Fig. 1—Steel forgings for oil well drills. Before Stub Lathe operations, in upper view; afterwards, in lower view.

drill. They come in three sizes, each having the central hole in several different positions. Three diameters on each arm must be turned and shoulders faced, accurately and smoothly. Material is tough steel difficult to cut cleanly by ordinary methods. Both arms of each forging must be machined at one chucking, and roughing and finishing must be completed successively on each arm. Sundstrand engineers cracked this tough nut by using the 15" Automatic Stub Lathe shown in Fig. 2 with tooling as shown in Fig. 3. Three chucks handle different sized forgings. Machine-spindle has heavy integral flange equal in diameter to outside of chuck. Each chuck has two heavy arms which support a cradle in which the work-piece is mounted by slipping

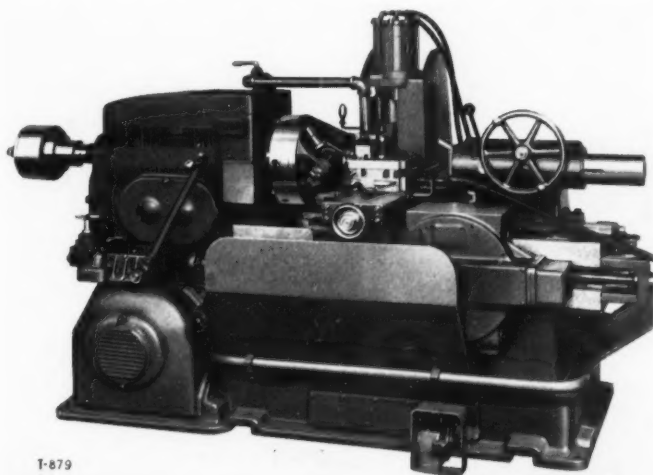


Fig. 2—15" Automatic Stub Lathe equipped for turning forgings shown in Fig. 1.

the reamed hole in the forging over a stud. Forging is centralized, so that equal amounts of metal will be removed from both arms, then clamped lightly in position. Operator now tightens a screw in the chuck, which holds work-piece solidly. Cradle is rotated, to bring one arm in position for turning, and locked. Rough turning proceeds on front slide, rough facing on back slide. Both slides then return to starting position, and machine stops. Operator indexes front tool-block to bring finish-turning tools into position. This automatically actuates a pneumatic cylinder which moves rear tool-block downward and presents two finishing tools to the work. After one arm is finished, operator indexes front roughing tools back to turning position (this automatically raises rear roughing tool to cutting position),

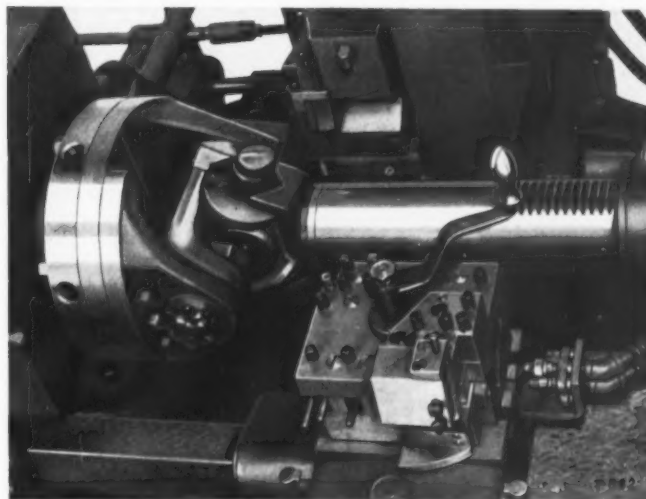


Fig. 3—Close-up showing chuck, tooling, and centralizing device.

operates foot control valve to unlock work-holding cradle, swings it to second position, again operates foot control valve to lock cradle in place. Automatic cycles described above for rough and finish turning are now repeated. Production of machine in commercial service actually exceeds estimates.

Cracking a tough nut is no new enterprise for Sundstrand engineers. If you have a tough turning or milling operation let us have complete data for an Engineered Production estimate.

SUNDSTRAND MACHINE TOOL CO.

2530 Eleventh Street, ROCKFORD, ILLINOIS, U. S. A.

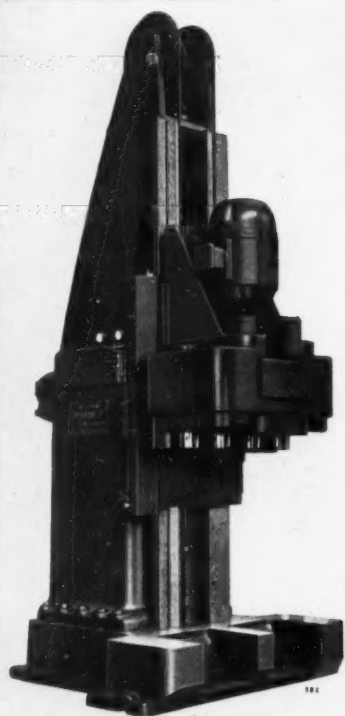
RIGIDMILS - STUB LATHES

3-Wheel Tool Grinders - Centering Machines
Balancing Tools - Bench Centers - Special Machines



MADE IN ROCKFORD, ILLINOIS, U. S. A.

Machinery—August, 1935



BARNES HYDRAULIC FEED

In A Heavy Vertical Boring Machine

Shown at left is a Barnes Vertical Boring Machine with 4-spindle heavy duty detachable type head. This machine will be equipped for boring cylinder blocks. Note simplicity of design attained largely because the compact powerful Barnes Hydraulic Feed Unit is fitted neatly into the column and connected to its cylinder by a minimum of piping. Note also the rugged construction, direct application of power to the boring head, and combination Vee and flat ways which assure accurate alignment. Ways have continuous positive lubrication. A single control governs the

automatic cycle of rapid approach, feed for boring, dwell for chamfering, quick return and stop. This is operated by adjustable protected dogs on the left side of the sliding head. This machine combines accuracy, power, easy operation, reliability and durability so that the purchaser obtains maximum production at minimum cost. The same advantages are provided by other Barnes Hydraulic Feed Machines with one or more heads for boring, drilling, and similar operations performed vertically, horizontally or in combination. Investigate. Write today for complete information.

ESTABLISHED
1872

W. F. & John BARNES Company
★
CONVERTIBLE
HYDRAULIC
MACHINE TOOLS
ROCKFORD, ILLINOIS, U. S. A.

ACCURATE, POWERFUL, ECONOMICAL
BORING and DRILLING MACHINES

Write Today for Complete Data—

The Rockford firms advertising above and in the preceding five pages also make *other* products for cutting costs, improving quality, and increasing your net profits. These other products are merely listed below—complete data will be supplied promptly on request. Address any or all of these firms at Rockford, Illinois, U. S. A.

Barber-Colman Company

149 Loomis Street

Milling Cutters, Hobs, Hobbing Machines, Reamers, Reamer Sharpening Machines, Special Tools.

Barnes Drill Co.

814 Chestnut Street

Drilling Machines, Tapping Machines, Automatic High Production Units, Machine-Tool Heads, Special Machinery and Fixtures.

W. F. & John Barnes Co.

300 S. Water St.

Horizontal and Vertical Boring, Drilling, and Tapping Machines, Diamond Boring Machines, Hydraulic Drill Units. Fixtures and Special Machinery.

Greenlee Bros. & Co.

2135 Twelfth St.

Independent Drill Units. Special Metal-Working Machinery. Woodworking Machinery and Tools. Hydraulic Conduit Benders. Contractor's Tools.

Mattison Machine Works

545 Blackhawk Park Ave.

Precision Surface Grinders, Abrasive-Belt Sheet Polishing Machines, Internal Tube Grinding and Polishing Machines.

Rockford Drilling Machine Co.

310 Catherine St.

High Production Boring, Drilling and Tapping Machines. Toggle-type Disc Clutches and Power Take-off Units for Gasoline and Diesel Engines.

Rockford Machine Tool Co.

2499 Kishwaukee St.

Rockford Economy Lathes, Hy-Draulic Shapers, Hy-Service Shapers, Drilling Machines, Accessories and special equipment for the machines made by this company.

Sundstrand Machine Tool Co.

2530 Eleventh St.

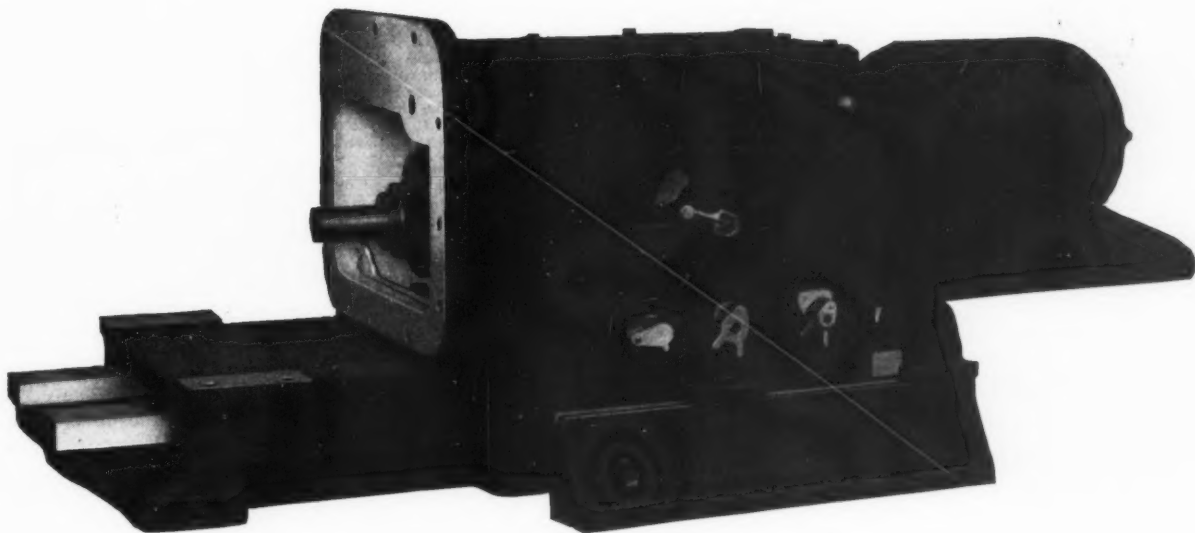
Stub Lathes, Rigidmils, Brake-Drum Turning Machines. Drilling and Centering Machines, Balancing Tools. Fixtures. Pumps.

MADE IN ROCKFORD, ILLINOIS, U. S. A.

Machinery—August, 1935

FOOTBURT

HYDRAULIC FEED UNITS



Three standard sizes of Hydraulic Feed Units make it possible to build up Way Drilling equipment to satisfy a wide variety of applications. All feed and drive parts are contained in the unit and units may be mounted on a machine frame at any angle.

Both feed rate and length of rapid traverse and slow feeds are variable. Simultaneous feed throw-in of all units is by means of Solenoids with push button located at most convenient position.

We will be glad to figure with you on Footburt equipment to handle your drilling work. Why not send us your blueprint together with production requirements?

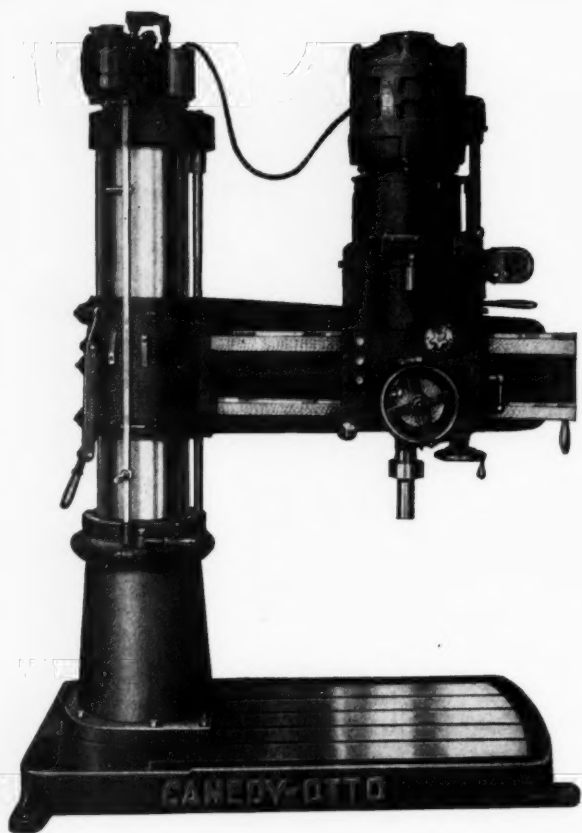
THE FOOTE-BURT COMPANY • CLEVELAND OHIO

Detroit Office: 4-151 General Motors Building

Chicago Office: 565 Washington Boulevard

C-O

Motor-on-the-Spindle RADIAL DRILL



Simple—Sensitive—Accurate

A real advance in radial drill construction. The spindle is centrally aligned and driven directly from the motor at high speeds, without gearing. Simplified construction that provides more sensitive operation. Drum control conveniently located in the head gives convenient and instantaneous change of speeds. Back gear with single conveniently located lever control provides eight additional speeds for heavier cuts.

Complete anti-friction bearing construction insures smooth operation—minimum wear. Push button control for forward, stop and reverse enables the operator to stop the spindle instantly and reverses spindle rotation faster than any hand lever mechanism. This feature makes available about ten reverses a minute for tapping. There are 12 spindle speeds 28 to 1800 R.P.M. or 20 to 1200 R.P.M.—available in 3 or 4 foot sizes.

All C-O Drills are "Precision Built" simply designed—efficient—and *sensibly priced*. Send for details of the C-O Radial and the rest of the line.

CANEDY-OTTO MFG. COMPANY
CHICAGO HEIGHTS, ILL.

CUT PRODUCTION COSTS with DELTA DRILL PRESSES

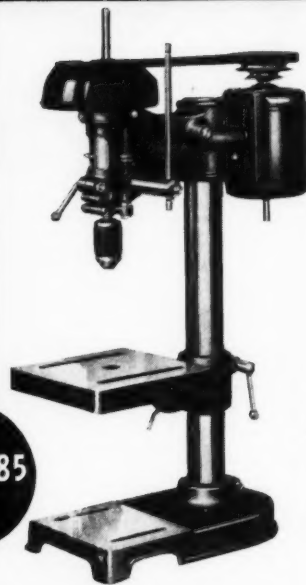
QUALITY TOOLS FOR ALL METAL DRILLING

Quality, accuracy, convenience, and unusual value—that is what every Delta quality tool offers you. The new Delta "Slo-Speed" Drill presses, priced as low as \$29.85 for the bench model, are a revelation in action! They are efficient for all types of metal drilling—in factories, machine shops, garages, and service stations. Their range of speeds enables them to be used in any general shop with drills from No. 60 up to 17/32" with utmost efficiency.

Speeds 390, 745, 1280, 2050 R.P.M.

Model No. 1295 Bench Type Delta "Slo-Speed" Drill Press with Delta-Grip chuck, motor bracket, motor pulley and belt, but without motor...

\$29.85

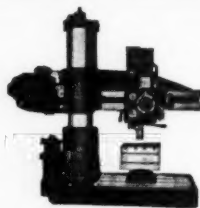


Any of the three "Slo-Speed" models, bench or floor type, can be supplied with "Delta-Grip" Chuck, Jacobs Chuck, Tapping Attachment or Spindle for No. 1 Morse taper shanks. Floor model

may be fitted with special production table. Write for full details about "Slo-Speed" Drill presses and name of nearest dealer.

DELTA MFG. CO.

606 East Vienna Ave., Milwaukee, Wis.



SCIENTIFICALLY RE-INFORCED

Can be furnished in Column Diameters of 9", 11", 13", 15", 17", 19", 22" and 28", with arm lengths of 3', 4', 5', 6', 7', 8', 9', 10', 11' and 12'; with almost any style table, electric or compressed air column binder, power traverse of head on arm and any style motor drive.

Carlton Radial Drills are built on the unit principle and scientifically re-inforced at all points of stress. This eliminates vibration, even at the highest speeds, and results in close limits of accuracy on production as well as tool-room work.

Other construction features include ball-bearings throughout, all steel gears running in oil, and a low-hung drive to spindle. Full details or estimates on request.

THE CARLTON MACHINE TOOL CO., Cincinnati, O.

MULTIPLE DRILLING AND TAPPING HEADS

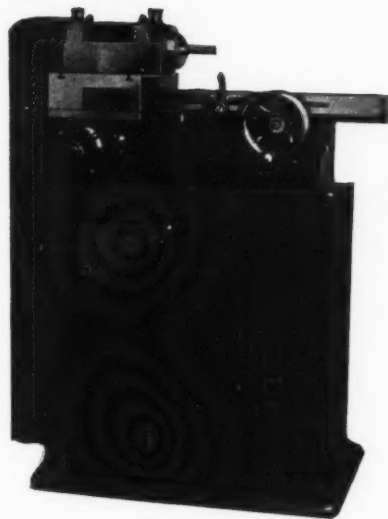
Let us tell you how the Buhr "Flexible Manufacturing" plan can drastically lower your special drilling and tapping equipment costs. Catalogs, suggestions or estimates submitted without obligation.

BUHR MACHINE TOOL COMPANY
ANN ARBOR, MICH.



**Drilling and Tapping
Machines**
(Automatic and Semi-Automatic)
LELAND GIFFORD CO.
WORCESTER, MASS.

STOKERUNIT



**Bores
Precision
Holes
at no
Increase
in Costs**

With Stokerunit, every bore is a precision bore—yet it costs no more than ordinary work. The machine's extremely light tool and clamping pressure eliminates distortion, deflection and chatter, and every hole is finished to the highest degree of size, roundness, straightness and finish. Low original and operating costs—delivered tooled for the job. Diamond or carbide tools, in all metals.

Details on request.

THE STOKERUNIT CORPORATION

5325 West Rogers St., MILWAUKEE, WIS.

DAVIS KEYSEATERS

**Two Models—Complete
Keyseating Equipment**

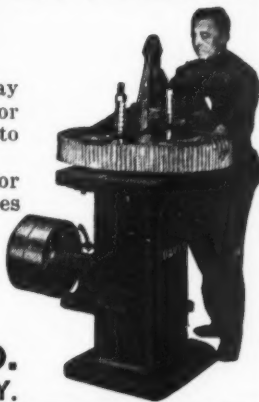
DAVIS TILTING TABLE KEYSEATER—may be set at any angle for straight or tapered keyways in bores tapering to 3" per foot.

DAVIS STANDARD KEYSEATER (shown) for straight keyseating. Both type machines utilize the DAVIS BROACHING PULL CUT—speedy and accurate.

Both models—3 sizes to cut keyways from 1/16" to 1 1/2" in hubs to 14" or longer with special equipment. Details?

DAVIS KEYSEATER CO.

405 Exchange St., Rochester, N. Y.



"HOLE HOG"

**Multiple Spindle Drillers, Borers, Counterborers,
Reamers, Lappers, Tappers, and
Universal Joint Machines**

Particularly Designed for High Production Work
MOLINE TOOL CO., Moline, Ill.

UNIVERSAL

(HORIZONTAL) BORING MACHINES

UNIVERSAL BORING MACHINE CO.

HUDSON, MASS., U. S. A.

"Where accuracy counts, we win"

4760



**NON-FLOATING
SPINDLE**

**FOOT PEDAL
CONTROL OF
TAPHEAD WITH
SPECIAL SAFETY
PULL SPRING
THAT ABSORBS
EXCESS PRESSURE**

*Perfect uniformity of
tapped parts! New
tapping speed... vastly
increased production
capacity... all possible
by the Haskins Method.*



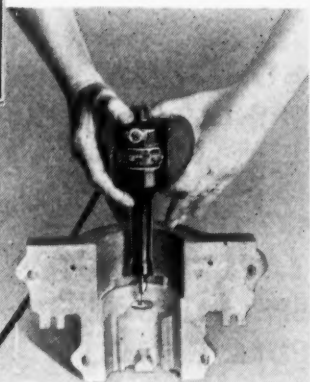
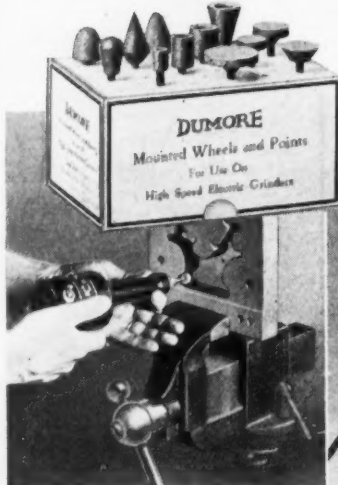
Tap Float Eliminated . . . Inertia Minimized

The new-type rigid spindle assembly on Haskins Tappers makes float impossible. Lightweight revolving parts reduce inertia to a very minimum. Foot pedal control leaves both hands free to present and remove the work. The special safety-pull spring absorbs excess pressure, eliminates the need of delicate control on the part of the operator and prevents damage to tap and hole. Simple and inexpensive fixtures add to the speed and precision of the Haskins Method. If you are interested in greater efficiency, greater production capacity, greater economy in your plant . . . investigate the advantages of the Haskins Method at once.

*Write today for free booklet describing this
method in detail. R. G. Haskins Company,
4634 West Fulton Street, Chicago*

Haskins
FLEXIBLE SHAFT EQUIPMENT
with Greater Adaptability

**I'LL PAY FOR MYSELF
IN NO TIME**



Correcting inaccuracies in a die with a Dumore No. 8-HG. Note the ease with which the grinder is handled.

A No. 8-HG finishing up a core box. This is one of hundreds of jobs it will do better—and more quickly.

The Dumore No. 8 Hand Grinder is usually called the "handiest tool in the shop"—it can be put to so many time and money saving uses. It is unequalled for finishing small openings, radii, and irregular shapes in all types of dies and molds . . . for correcting inaccuracies in blanking dies . . . providing top rake of a forming tool . . . touching up taps and cutters . . . sharpening dinking, button and acorn dies . . . lapping small holes . . . etc., etc.

The Dumore No. 8 is a high speed grinder, light in weight but powerful. It has a 1/40 h.p. universal motor, dynamically balanced for smoothness. An effective ventilating system makes continuous duty possible—a positive filter prevents the entrance of harmful dust. It's the kind of a tool that once you own it, you wonder how you ever got along without it. Write for folder "Hand Grinding the Modern Way."

DO YOU KNOW that the Dumore Co. is one of the Country's leading manufacturers of precision built fractional h.p. (series wound) motors? Dumore engineers have had 22 years experience in designing and adapting power units.

DUMORE
GRINDERS

MAIL THIS COUPON FOR GRINDING FACTS

THE DUMORE CO., Dept. 145-H
Racine, Wisconsin

Send me folder "Hand Grinding the Modern Way."

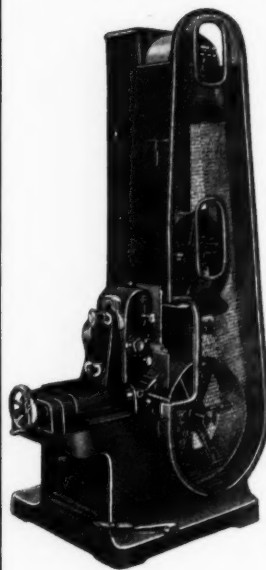
Name.....Title.....

Firm.....

City.....State.....

Our Industrial Distributor is.....

PRODUCTION POLISHING MACHINES



**HIGH SPEED—
CENTERLESS FEED—**

machines for cylindrical work using either Abrasive Belts or Wheels for the finishing member.

The greatest producers and labor savers offered for any class of Polishing or Finishing within their range.

Real Cost Reducers

Also
The Peerless Line Abrasive Belt Surfacers, Floor and Bench Machines

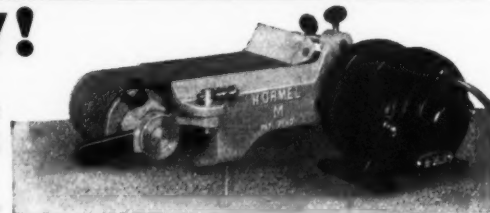
Send us your Finishing Problems for study

PRODUCTION MACHINE CO.
GREENFIELD, MASS.

AGENTS—Metch & Merryweather Machinery Co., Cleveland, O., Pittsburgh, Pa., and Cincinnati, O., The Chas. A. Strelinger Co., Detroit, Mich., Mr. P. H. Arden, 565 W. Wash. Blvd., Chicago, Ill.

NOW!

An
Inexpensive
**ABRASIVE
BAND
GRINDER—**



"Built Like a Machine Tool"

The Hormel-M Grinder is sturdily built with a supporting leg under the grinding table to eliminate vibration and tipping due to pressure on belt. Ball bearing throughout, equipped with Alemite lubrication, complete with grease gun. Write for illustrated folder on this and other styles and sizes.

HORMEL-M GRINDER
WALLS SALES CORP., 96 Warren St., New York, N.Y.

**ABRASIVE
SURFACE GRINDER**

**HORIZONTAL
and
VERTICAL
for
TOOLROOM and
PRODUCTION**

Write for Particulars

ABRASIVE MACHINE TOOL CO., East Providence, R.I.



Calder Wheel Dressers

Huntington — Paragon — Roughing.
Immediate deliveries on all kinds and sizes. Send for prices.

Dressing tool manufacturers since 1897

GEORGE H. CALDER CO., Lancaster, Pa., U. S. A.

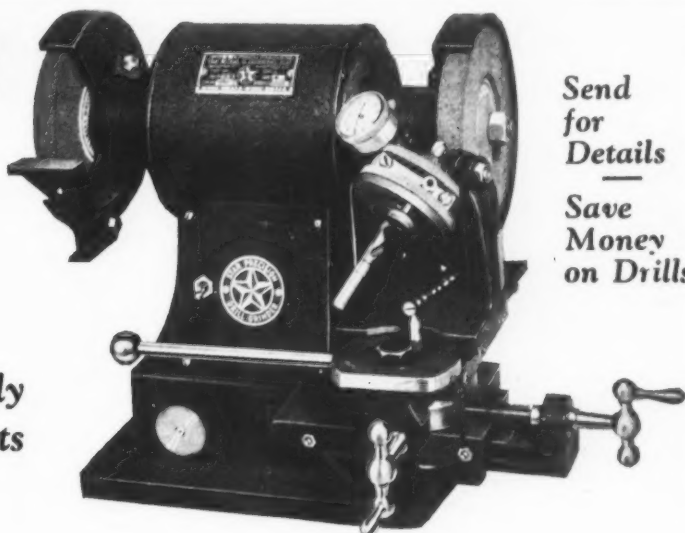
NEW STAR Precision Drill Grinder

Grinds 81 Drill Sizes Accurately
... No Extras ... No Attachments



A precision machine that puts drill grinding on a production basis with a working range that covers practically all your drill sharpening needs.

The New Star—by its simplicity and accuracy saves as high as 50% on drill costs and insures uniform accuracy that guarantees perfect holes.



Send
for
Details
—
Save
Money
on Drills

It grinds to the following correct angles and clearance for cast-iron and steel: 59° angle of the lips, 120° to 135° angle of the drill point, and a 12° clearance of the lips. Grinding is done on the peripheral face of the wheel, greatly lessening the tendency to burn as when grinding with the side of the wheel.

STAR MACHINE AND ENGINEERING CORPORATION

Division of Star Electric Motor Co., Bloomfield, New Jersey

OLIVER

For Better Tool Service

The Oliver No. 2 "Arc" Face Mill Grinder.

The Oliver Tap Grinder.

The Oliver Drill Grinder.

The Oliver Drill Point Thinner.

The New Oliver Tungsten-Carbide Grinder.

The New Oliver Diemaking Machine.

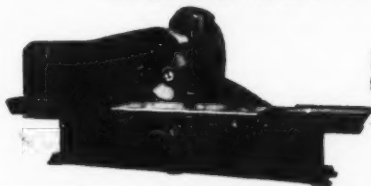
Send for details of Oliver Machines

OLIVER INSTRUMENT CO.

1410 E. Maumee Street, Adrian, Michigan

Specialists in Tool and Cutter Grinding Equipment

BRIDGEPORT HYDRAULIC FACE GRINDERS



Rugged, powerful machines
for production work.

BRIDGEPORT SAFETY
EMERY WHEEL CO., Inc.

1283 W. Broad St., Bridgeport, Ct.

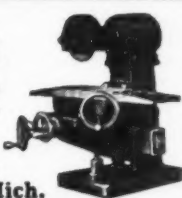
THIS NO. "O" GRAND RAPIDS SURFACE GRINDER

Has No Equal on Small,
Delicate Surface Grinding Operations.

Bulletin on Request.

Gallmeyer & Livingston Co.

350 Straight Ave., S.W., Grand Rapids, Mich.



RANSOM



RIGID GRINDING MACHINES

This Ransom RW Type Grinding Machine gives complete rigidity, for the operation of wheels up to 6500 surface feet per minute. It takes direct and alternating current, and wheels from 11" to 36". The machine has an unusually large floor area, which further promotes stability, and the frame is out of the way of the workman. Extra large S.K.F. ball bearings and spindles are used, the bearings equipped with a special type oil filter to guard against abrasive.

Complete units in themselves, R-W Type Machines can be equipped with push button control. Rest and rest brackets are adjustable and removable. Catalogs on request.

Ransom Also Makes: Foundry Grinders, Tool Grinders; D.C. or A.C. Current; various types of drives; up to 36" wheels.

RANSOM GRINDING MACHINE CO.

Oshkosh, Wisconsin, U. S. A.

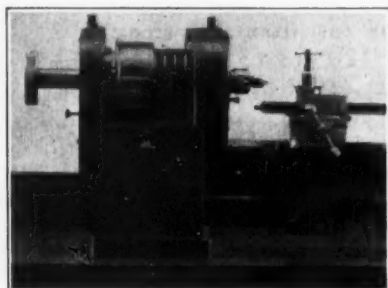
Compare The RIVETT ROLLER BEARING LATHE WITH YOUR PRESENT BENCH LATHES

Compare the Operating Conveniences

The Rivett Roller Bearing Lathe combines every advantage of the enclosed head (see cut at right) with the indispensable qualities of the open head (see cut below showing hinged cover raised)—for instance: to apply new endless belts; to index; to turn or hold spindle by hand for measuring, etc.

Compare the Spindle Speeds

Equipped with super-precision Timken roller bearings (1175 pounds radial load and 1180 pounds end thrust, continuous duty). This lathe is powered to drive at eighteen selective speeds from 100 to 2300 r.p.m.



ENCLOSED HEAD—V-BELT DRIVE

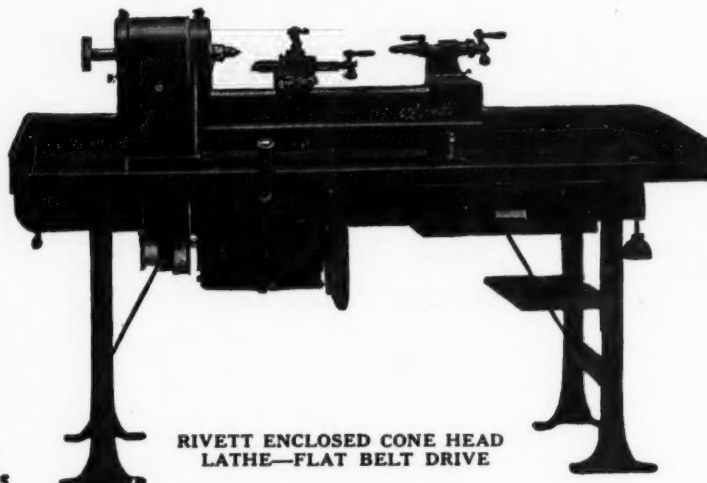
Compare the Drives

Speed Box driven, the roller bearing cone head lathe is furnished with 6, 12 or 18 well-graded spindle speeds both forward and reverse. With V-belt drive to the head six forward and reverse speeds are obtained from constant speed motor. Automatic brake stops spindle instantly.

SEND FOR RIVETT BULLETIN 505-RB. (Just off the press.)

RIVETT LATHE & GRINDER, INC.
BRIGHTON, BOSTON, MASS.

Pioneers in Bench Lathe Development



RIVETT ENCLOSED CONE HEAD
LATHE—FLAT BELT DRIVE

See
**RIVETT
BENCH LATHE
EXHIBIT
BOOTH 1010
NMTBA Show
Cleveland**

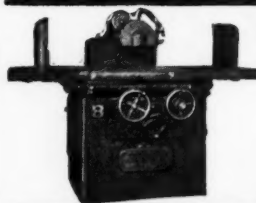


FOR OVER
A QUARTER OF
A CENTURY



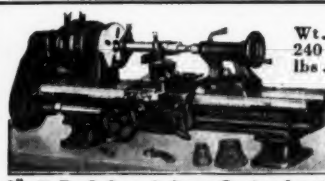
**THE PIONEER
MANUFACTURER OF
AUTOMATIC CHUCKING
EQUIPMENT**

POTTER & JOHNSTON MACHINE CO.
PAWTUCKET, R. I., U. S. A.



**DIAMOND
TYPE G SURFACE
GRINDING MACHINE**

A FAST, ACCURATE, AND COMPACT
MACHINE. WRITE FOR BULLETINS.
DIAMOND MACHINE CO., Providence, R. I.



9"x3" Back-Geared, Screw Cutting \$75
"Workshop" Bench Lathe.....

SOUTH BEND LATHES

96 other sizes and types of Back-Geared, Screw Cutting Lathes from 9" to 18" swing, \$75 to \$1500, on terms if desired, shown in new General Catalog No. 94. Write for copy.

South Bend Lathe Works
764 E. Madison St.,
South Bend, Indiana, U. S. A.

**SPRINGFIELD
GEARED HEAD
ENGINE LATHES**

The Springfield Machine Tool Co., Springfield, Ohio



**High-Speed Profilers...
Die-Cutting & Engraving
Machines Vertical &
Universal Milling Machines**

GEORGE GORTON MACHINE CO.

RACINE, WISCONSIN, U. S. A.

The Desmond DIAMO-CARBO



GRINDING WHEEL DRESSER

There is no better all-around tool room dresser! It attains, at a fraction of the cost, the efficiency of the diamond on a great many jobs, and except for the most exacting precision work, can be used to dress and true all wheels up to the "hard" grades. In hand-forming special shapes, the Diamo-Carbo turns wheels to the most delicate shapes without fear of breaking the edge.

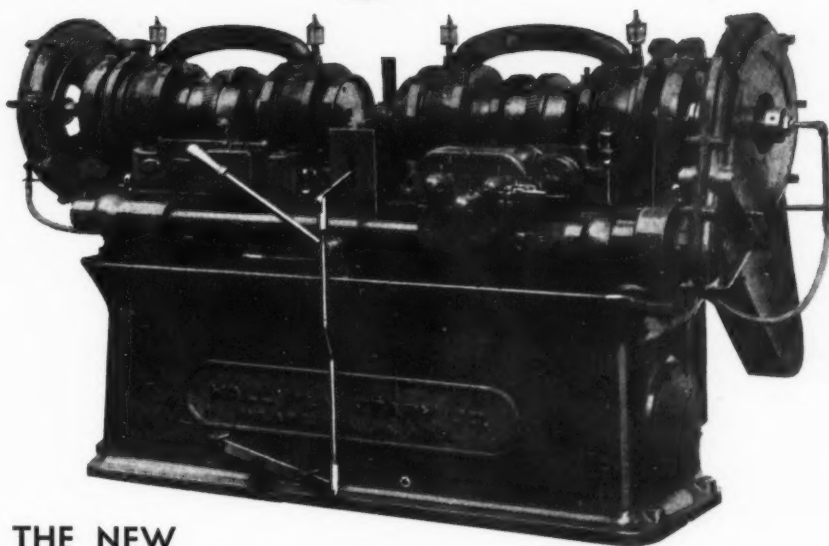
Wide range of types and sizes. Ask for Catalog "B" giving our complete line and prices.

DESMOND-STEPHAN MFG. CO., URBANA, O.



HALL PLANETARY MACHINES at the Show

BOOTH-14



THE NEW
DOUBLE HEAD PLANETARY

Single and Double Head Models will be shown—with samples and production records of important automotive and industrial work.

You must see the machines—and results—to fully appreciate the importance and economy of Planetary Production Methods.

PLANATHREADING—cutting internal or external threads by advancing cutter spindle on a master lead thread while work is held stationary.

PLANAMILLING—rough or finish milling simple, taper or multi-size holes, also external cylindrical surfaces while work is held stationary.

Will be glad to send you the New Book "The Planetary—What It Is Doing."—but we'd rather *show* you.

THE HALL PLANETARY CO.

Fox St. and Abbotsford Ave.
PHILADELPHIA, PA.

CONE 4-SPINDLE AUTOMATICS

are economical and accurate producers of screw machine parts up to 6" diameter, 7" milling length. They cut costs, increase production, boost profits. Write for particulars.

CONE AUTOMATIC MACHINE CO., Inc., Windsor, Vermont

REPRESENTATIVES:

Detroit: J. C. Austerberry's Sons, 684 E. Congress St.
Chicago: John H. Glover, 2127 N. Sayre Ave.
Ohio: S. B. Martin, 1077 Erie Cliff Drive, Lakewood, Ohio.
Indiana: G. A. Richey, Chamber of Commerce Bldg., Indianapolis.
Pennsylvania: Arch Machinery Co., 1029 Park Bldg., Pittsburgh, Pa.
New York State: Syracuse Supply Co., Syracuse, N. Y., Rochester, N. Y.
Philadelphia, Pa.: Lloyd & Arms, Inc., 133 South 36th St.
New England: Potter & Johnston Machine Co., Pawtucket, R. I.
California: C. F. Bulotti Machinery Co., 829-31 Folsom St., San Francisco, Calif.

ACME FORGING MACHINES

FORGING MACHINES

—for speed, for accuracy, for dependability. Eliminate enlarged shanks, eccentric upsets and excessive flash and reduce cost per part. Send for Catalog.

The Acme Machinery Co.
Cleveland - Ohio



Porter-Cable Machine Co.
Syracuse, N. Y.

Compact power—
speed—strength

For rapid manufacture of
duplicate parts

WALTHAM
TRADE MARK
REGISTERED U.S. PAT. OFF.

Fast Production on small threaded parts



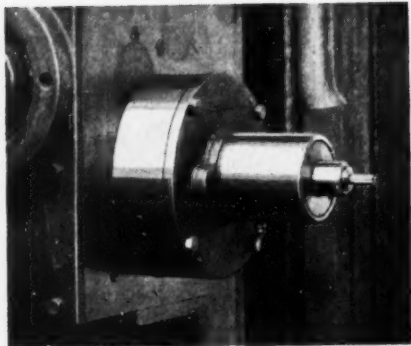
The Waltham Thread Miller possesses automatic features that result in outstanding production results on parts 2" or less in diameter, and on many parts up to 3". It is accurate at all speeds, and can be easily converted through special equipment for internal work.

Held on centers, a length up to 8¾" long can be threaded—10" with a spring chuck. An improved coolant system and a cutter head with a 35° swivel range (also swivels horizontally) are just two among many features. Write for circulars.

WALTHAM MACHINE WORKS

Newton Street, Waltham, Mass.
Makers of Small Thread Millers, Gear Cutters and other
Small Automatic Machines

Rowbottom for Cams



Rowbottom Cam Milling Machine—equipped with our especially designed high speed milling attachment for cutting barrel or other type cams requiring a small cutter. Maximum speed 1200 R.P.M.

Estimates

provide interesting data for cost comparisons that proves cams need not be prohibitively costly parts. Whether you need a single cam for a special machine—or large quantities you will find Rowbottom specialized equipment gives us an "edge" on quality as well as price.



Rowbottom Cams are as accurate as you specify, metal quality is as you wish. Rowbottom Cam experts spend their time figuring new ways, devising new equipment to reduce costs on these ever more important parts.

Get a Rowbottom Estimate first on your next cam needs.

THE ROWBOTTOM MACHINE CO., WATERBURY, CONN., U. S. A.

HIGH INTENSITY LIGHT ANYWHERE

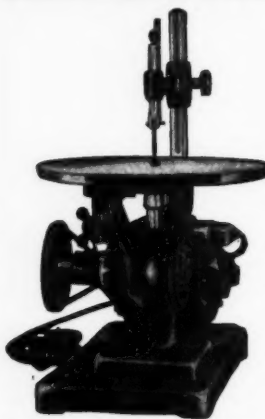
Solves Every Requirement for Localized Lighting

Essentials for adequate lighting, safety and convenience—furnish everywhere required, the Fostoria Machine Lampshade substantially to improve the efficiency of workmen, increasing production, reducing spoilage and preventing accidents. A Fostoria representative will gladly analyze your requirements and submit recommendations without obligation.

The Fostoria Process
Steel Corporation
Indianapolis, Ind. • Detroit, Mich.

Fostoria MACHINE LAMP

ILLINOIS DIE FILING MACHINE



A compact, reliable, smoothly operating machine for filing, stoning or sawing.

Furnished with or without overarm.

Size 12" by 18". Table 12" diameter 12" high. Spindle stroke 1". Height with overarm 21 3/4".

Furnished regularly with 1/2 H.P.A.C. motor with round belt. It can be furnished for flat belt drive when necessary.

Descriptive circular and prices upon request.

ILLINOIS TOOL WORKS

2501 N. KEELER AVE., CHICAGO, ILL.
Manufacturers of Milling Cutters, Hobs and Special Tools.



**WIRE FORMING MACHINES,
FOOT AND POWER PRESSES.
TUMBLING EQUIPMENT.
MULTIPLE SPINDLE LATHES—
For Chucked and Centered Work.**

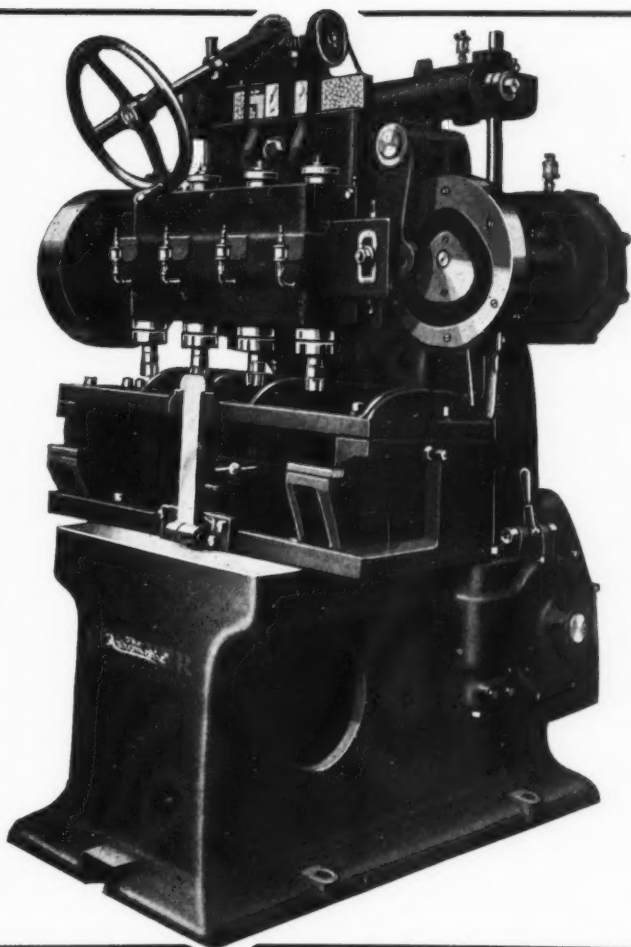
THE BAIRD MACHINE COMPANY
BRIDGEPORT, CONN.



Metal Working Machines for

Boring, Bending, Drilling, Forming, Turning, Milling, Planing, Profiling, Punching, Sawing, Shearing, Slotting, Straightening, Threading, Tapping, Etc. **SEND US YOUR INQUIRY.**

Consolidated Machine Tool Corp. of America
Rochester, New York



Coulter
Automatics

PROFILE MILLERS

TWO TO EIGHT SPINDLES
AS REQUIRED

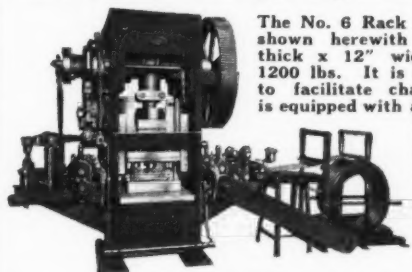
Particularly adapted to the machining of the Compression Spaces in Automobile Engine Cylinder Heads. Average floor to floor time per complete head two to four minutes.

Also for economically machining irregularly shaped pieces in duplication on a production basis.

Send us detailed prints and production requirements, and we will promptly submit suggestions, specifications and quotation on a machine suitable for your requirements.

THE AUTOMATIC MACHINE CO.
BRIDGEPORT, CONN., U. S. A.

HEAVY STOCK can be fed best with LITTELL'S High Speed Roll Feeds



The No. 6 Rack and Pinion Roll Feed shown herewith handles stock 1/8" thick x 12" wide from coils up to 1200 lbs. It is mounted on brackets to facilitate changing of dies; and is equipped with an Eccentric Operated Scrap Cutter, Power Driven Straightener, Oiler, and Power Driven Reel.

Write for further facts to—

Mfrs. of Punch
Press Feeds
and Reels

F. J. LITTELL MACHINE CO.
4127 Ravenswood Ave. CHICAGO

FIFTY YEARS' EXPERIENCE

Cash or Terms—Allowance on old tool

Hot and Cold Swaging Machines . . Hammering Machines . . Sensitive Drills . . Multiple Spindle Drilling and Tapping Machines . . Multiple Spindle Attachable Drill Heads . . Automatic Drilling and Tapping Units . . Special Machinery.

ALSO REBUILT TOOLS OF OUR OWN MAKE

LANGELIER MFG. CO., PROVIDENCE, R. I.

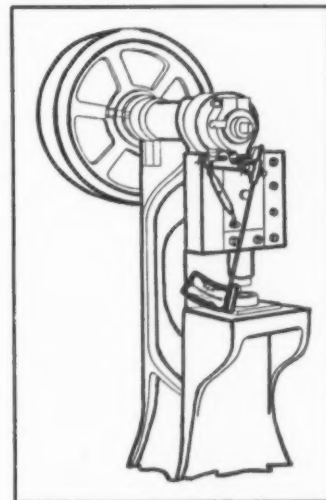


Operator Safety

Taylor-Shantz D & M Automatic Press Guards fully protect the operator working from normal position without retarding his productive motion. They are simple, inexpensive safety insurance applicable on any make, size or type of press.

In writing for details state name, type, size, stroke of press—and whether left to right or right to left hand swing is preferred.

**Taylor - Shantz
Company**
485 St. Paul St.
Rochester, N. Y.



GRANT RIVETS SAMPLES



Grant
Noiseless
Rivet
Spinner

Send them on (with the rivets); we would like to *show* you the kind of work done by Grant Riveters and quote you on time and costs.

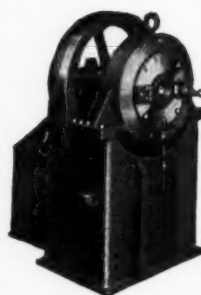
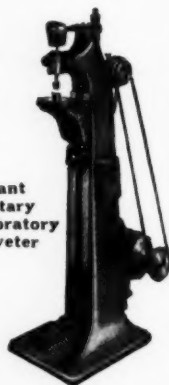
Two types of machines in sizes to handle a wide range of large and small work offer a working range that meets most needs—or Grant engineers will adapt a standard model *economically* for your special purpose.

Send for details of Grant Riveters and of some interesting applications.

**THE GRANT MFG.
& MACHINE CO.**

N. W. STATION, BRIDGEPORT, CONN.

Grant
Rotary
Vibratory
Riveter



Swaging—*What*
it is and *How*
it is done on

TORRINGTON SWAGING MACHINES

All explained in booklet—"The Torrington Swaging Machine"—Your copy mailed on request.

Examples of many possible operations by swaging method:—


- | | |
|---------------------------|---------------------------------|
| 1 Point rods for drawing | 8 Tap blanks |
| 2 Pointed rods and tubing | 9 Ice pick points |
| 3 Tapered rods and tubing | 10 Meat hooks |
| 4 Acetylene torch tubes | 11 Refrigerator expansion bulbs |
| 5 Curling iron tubes | 12 Sizing and Reducing wire |
| 6 Nail Sets—Prick Punches | |
| 7 Steel furniture legs | |

Present Owners of Torrington Swaging Machines are quoted promptly on request for prices for die renewals, etc.

THE TORRINGTON CO.

55 Field Street

Torrington, Conn.

| | | |
|--|---|-------------------------|
| BETTER-MADE DIE SETS | BAUMBACH | AT LOWER COST |
| 24 DIFFERENT STYLES |  | OVER 95,000 SIZES |
| Semi-Steel | STANDARDIZED DIE SETS | Drop Forged Steel |
| Send for Our New 208-Page Catalog | | |
| E. A. BAUMBACH MFG. CO. | | |
| 1810 South Kilbourn Ave. Chicago, Ill. | | |

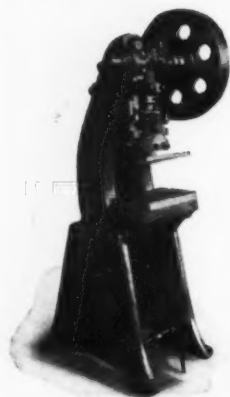
AUTOMATIC STOCK FEEDS AND STOCK REELS



New Catalog describes the revolutionary U.S. Slide Feeds which ENFORCE accuracy.

Also covers the highly efficient U.S. Roll Feeds and U.S. Stock Reels. Write for it.

U. S. TOOL COMPANY, INC., Ampere, N. J.



Thirty Years
of
Service and Quality
has been our record

We Build
POWER PRESSES
of all styles and sizes
Patent Percussion Presses
Our Specialty


ZEH & HAHNEMANN CO.
182 Vanderpool St., Newark, N. J.

V & O "LONG SLIDE" PRESSES

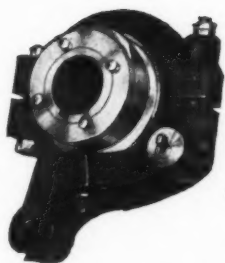
THE V & O PRESS COMPANY, HUDSON, N. Y.

17 STYLES AND SIZES

MERRELL

PIPE THREADING  **MACHINES**

TOLEDO, OHIO



• SWAINE •

ENTIRELY NEW Patented Automatic Brake for Single Acting Power Presses

Sheet metal drawn without shock, or rebound of compression springs, rubber bumpers and all pressure devices.

NO POWER LOSS

All the energy of flywheels and gearing of power presses delivered to the drawing dies, giving you full efficiency of your press equipment.

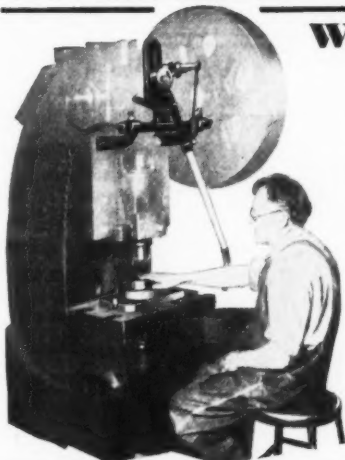
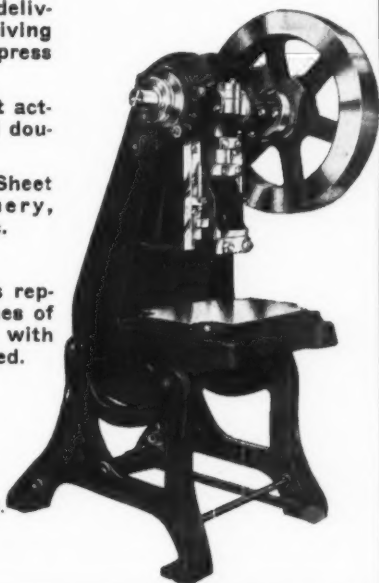
Sizes for all makes of direct acting presses, both single and double crank easily applied.

Designers and builders of Sheet Metal Working Machinery, Stamping Presses, Dies, etc.

The No. 37 Inclinable Press represents one of our many lines of power presses. It is shown with the Automatic Brake applied.

Further information on request.

Manufactured by
The Fred J. Swaine Mfg. Co.
1306 N. Seventh St.
St. Louis, Mo.



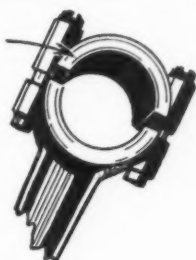
Wiesman Safety Press Guards

SAFETY on the press job without interference with production. The Wiesman Press Guard sweeps the operator's hand out of the way as the press descends—there is no halt in his natural working movements and danger of accident is automatically eliminated. Low priced—simple—easily attached. Use the Wiesman on all types of power presses—right or left hand stroke. Send for details—prices.

Wiesman Mfg. Co.
31 to 35 South St. Clair St.
DAYTON, OHIO, U.S.A.

CENTRIFUGAL BABBITTING

No blow holes. Any impurities are deposited at the smallest diameter and so are removed in the first boring operation. The bearing becomes an integral part of the rod and cap. M.C.E. CENTRIFUGAL BABBITTING MACHINES will give an average production of 40 connecting rod bearings per hour. Machines to handle 8", 12", and 18" rods. We will be glad to give you production estimate on your work, and quote on the necessary equipment. PAMPHLET ON REQUEST.



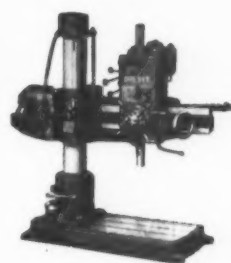
Production Engineering—Consulting—Designing

O. C. Kavle, L. W. Moulton and Staff of Associate Engineers and Designers—Known as

Manufacturers' Consulting Engineers
Syracuse Building, SYRACUSE, N. Y.

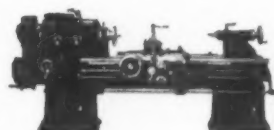
DRESES RADIAL DRILLS

Also Monitor Brass Lathes. Multi-duty radials, heavy duty—accurate—compact. Sizes 3 to 8 feet inclusive. Manufactured by The Drees Machine Tool Co.



BOYE & EMMES LATHES

Fine lathes for 40 years. Medium and heavy duty types. 14" to 36" swings. Manufactured by The Boye & Emmes Machine Tool Co.



KLING GRINDERS

Also structural fabricating machinery. Heavy duty built in a full range of sizes. Manufactured by Kling Bros. Engineering Works.



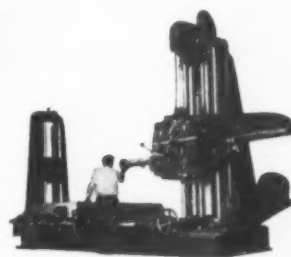
CLEEREMAN DRILLING MACHINES

Fully geared—automatically oiled—full anti-friction drills. Standard sizes 21" to 28". Manufactured by Cleereman Machine Tool Company.



OHIO SHAPERS & BORING MILLS

Ohio Dreadnaught Shapers 16" to 36" sizes. Horizontal Boring Mills all types—4", 5", and 6" spindles. Manufactured by The Ohio Machine Tool Company.



For descriptive literature and complete information on any of the above machines, write

General Distributors

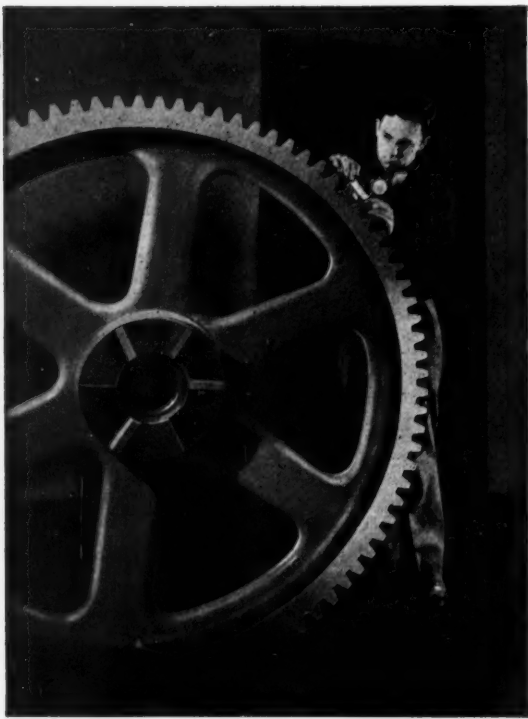
BRYANT MACHINERY & ENGINEERING COMPANY

MACHINE TOOLS - WELDING EQUIPMENT - GENERAL METAL WORKING MACHINERY

THE CHICAGO DAILY NEWS BUILDING
400 WEST MADISON STREET

• CHICAGO •

REPRESENTATION IN PRINCIPAL CITIES



This Stahl-made Gear is part of a punch press clutch. It weighs a ton and a half, is semi-steel, and has a tensile strength of 50,000 to 55,000 lbs. Let us quote on your metal or non-metallic needs, large or small.

STAHL GEARS



Care in the selection of raw material, care in its cutting, careful inspection, are fundamental reasons for the continued specification of Stahl Gears by machine manufacturers.

Men, methods and equipment of proved efficiency, long experience, are further assurance of fine gears at lowest cost consistent with quality, on every Stahl Gear order.

THE STAHL GEAR & MACHINE CO.

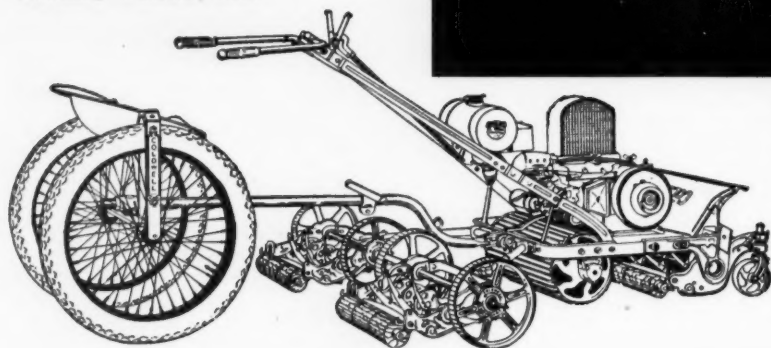
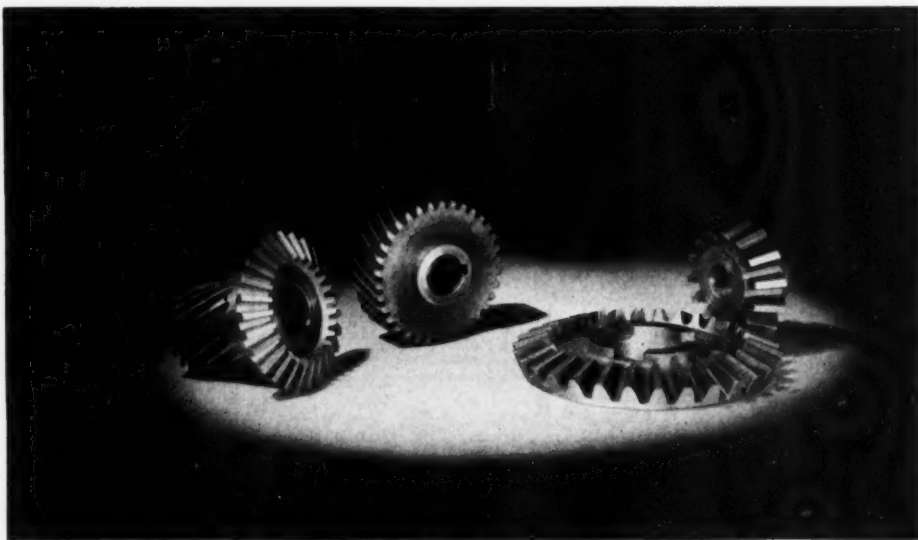
1390 E. 40th St., CLEVELAND, OHIO

PERKINS *Custom Cut* GEARS

FOR POWER LAWN MOWERS

Transmission gears of high grade steel—properly heat treated—accurately machined—Perkins Gears help provide a dependable durable driving mechanism, for this well known power lawn mower.

We manufacture gears for all types of machines to specifications—including bevels, spirals, one piece combinations of bevels and spirals, spurs, helicals, worms, wheels, etc.



Perkins Gears are used wherever gears are needed in such quality products as movie apparatus, electrical household equipment, floor sanders, electric portable tools, etc., because they meet manufacturers high standards.

**PERKINS MACHINE
& GEAR COMPANY**
SPRINGFIELD, MASS.

HEAVY DUTY GEARS

*"from
stock"*

*ready for
immediate
shipment!*

Boston Heavy-Duty Gears will stand an unusual amount of severe service over a long period of time due to certain superior qualities inherent in the materials of which they are made. Also, they cost less than made-to-order gears of equal quality, and are, in many instances, far superior in design, materials, and workmanship.

A wide range of types and sizes makes it especially easy to select the right gear for the purpose. Large stocks are on hand at Boston Gear Service Stations located in the principal industrial centers of the country.

Send NOW for Catalog M850T

*We shall be glad to assist you in the
matter of recommendations*



BOSTON GEAR WORKS, INC.
NORTH QUINCY, MASS., U.S.A.
TELETYPE CONNECTIONS

BOSTON GEARS



FIRST—SCIENTIFICALLY PLANNED

Second—
accurately
machined.
Result—
a smooth-running
combination.




"THEY LIVE ON THE JOB"

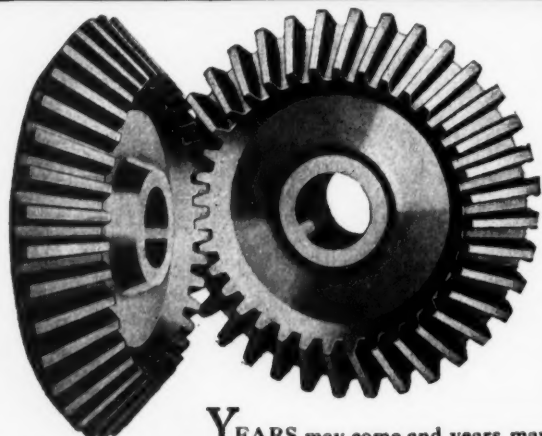
Massachusetts Gear & Tool Company

34 Nashua St.

Woburn, Mass.

Let
Mass.  Gears
combine their ideas
with your plans.
Result—
satisfaction.

GEARS · GOOD GEARS ONLY



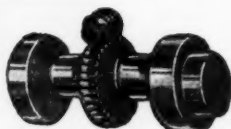
YEARS may come and years may go, but Cincinnati Gears go on practically forever—if properly used and cared for. It's the Cincinnati combination of correct material, and precise workmanship that does the trick.

Best of all, these quality gears are produced at prices which usually mean a substantial saving to the purchaser. May we quote on your requirements? No charge or obligation—just a money-saving opportunity to check against your present costs.

THE CINCINNATI
· **GEAR COMPANY** ·
CINCINNATI · · · OHIO



Gears—Worms—
Cams—Contract
Machine Work—quality products
produced by experienced men in a
well equipped modern plant. The
right production set-up for com-
pletely satisfactory service.

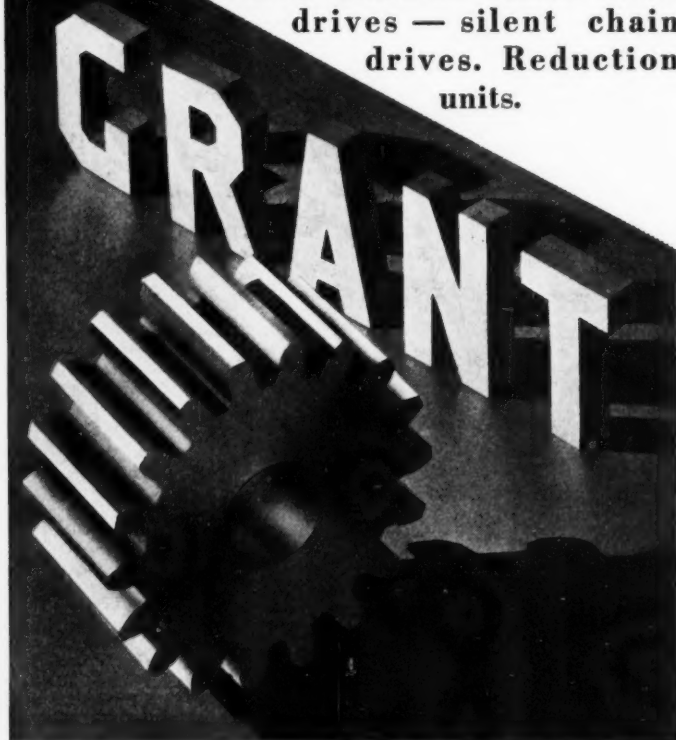


Send blue prints for
estimates.

The Hartford Special Machinery Co.

293 Homestead Ave., Hartford, Conn.

The name Grant is a safe guide to reliable
gears. Spur, bevel, mitre, internal,
worm. Ratchets. Roller chain
drives — silent chain
drives. Reduction
units.



Is our complete gear catalog in your files?

GRANT GEAR WORKS, BOSTON

ESTABLISHED 1877

THE SIGN OF GOOD GEARS



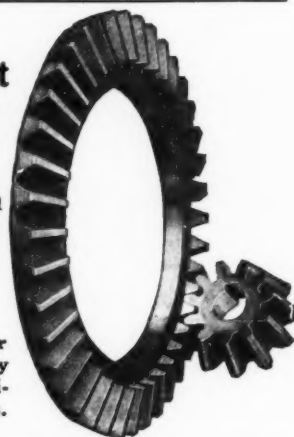
**Big
Straight
Bevels**

50" Diameter
2 1/2" Circular Pitch

*Just One of Our
Specialties*

Let Us Quote.

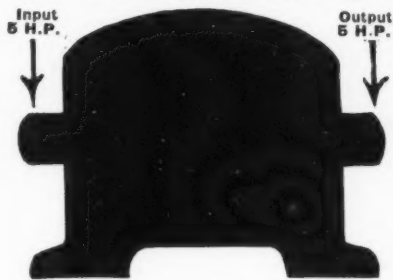
Quick service on all our
non-metallic gears. Forty
years' gear making experi-
ence behind our products.



DIEFENDORF GEAR CORP., SYRACUSE, N. Y.

S-B REDUCERS

Do Not Absorb Power in Making Reductions



NO "POWER SPONGES"

S-B has eliminated the inefficient factors in Gear Reducer design that act as "power sponges." Unusual gearing (patent applied for) keeps 20% of the teeth always in mesh—accurate construction—modern production methods—they deliver rated power in service.

Any ratio from 4 to 1 to 180 to 1 obtainable in a single stage of reduction with exceedingly high efficiency regardless of ratio.

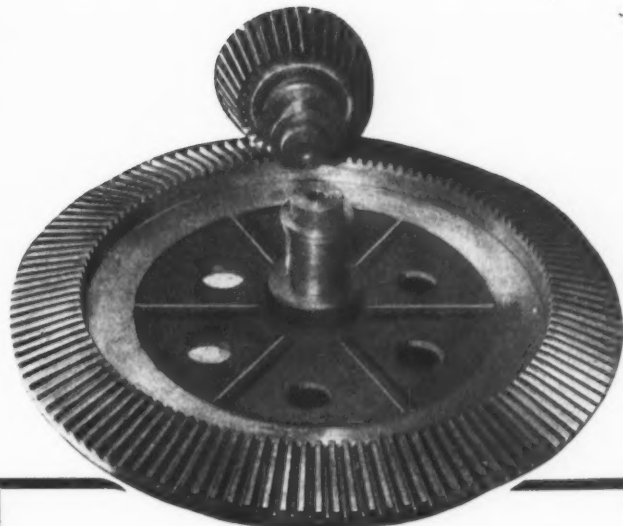
Complete details, specifications Stock units periodically submitted for test to established commercial testing laboratory. Two summaries of reports.

Reducer size . . . 2 1
Rated H.P. . . . 1 .3
Ratio 120 to 1 175 to 1
Input Speed . . . 1800 1750
Output Speed . . . 15 10
Input H.P. . . . 1.120 .391
Output H.P. . . . 1.025 .333
EFFICIENCY. 91.5% 85.2%

SIER - BATH GEAR CO.

Gear Specialists for 29 Years
640 W. 58th Street
New York City

| ELECTRICAL TESTING LABORATORIES | | | |
|--|--------------|------------|-------------|
| GENERAL TESTING AND LABORATORIES | | | |
| REPORT NO. 1000-1 | | | |
| DATE: 10/10/35 | | | |
| S-B Gear Corporation 340 West 100th Street New York, N. Y. | | | |
| Description: We are submitting herewith the results of the mechanical efficiency tests, generally made on gear reducers. | | | |
| Input Speed | Output Speed | Input H.P. | Output H.P. |
| 1800 | 1750 | 1.120 | .391 |
| 1750 | 1500 | 1.025 | .333 |
| EFFICIENCY 91.5% 85.2% | | | |
| The complete data covering these tests has been tabulated in our reports Nos. 1000-1 and 1000-2. | | | |
| Signed: 10/10/35 | | | |



Name any type of Gear—and we'll be able to make it

No matter what type of gear you need (or what size or material either), you can send to Philadelphia for it. We've specialized in gears of all types for nearly 50 years, and our stock of hobs and patterns is now so large that we can give you just what you want and, further, we'll give it to you when you want it. Our 48 page "Gear Book" is full of information needed by gear buyers. We'd be glad to send you a copy. Just write for it.

PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducers

ERIE AVE. and G ST., PHILADELPHIA

BRANCH OFFICES:

New York: 330 W. 42nd St. Pittsburgh: Cham. of Comm. Bldg.

GITS Constant-Level Oilers with Unbreakable Bottles



Maintain correct oil level. Prevents burning out of motors and bearings.

Furnished in both hinged and removable bottle types. Capacity 5/8 to 32 oz.



Send for Catalogue.

EASILY FILLED

GITS BROS. MFG. CO.

1858 S. Kilbourn Avenue. - - Chicago, Ill.

EARLE

Cut Spur, Bevel, Herringbone and Worm Gears

All sizes. Every description. Operating Machinery for Bridges, etc. "Lea Simplex" Cold Metal Saws.

The Earle Gear & Machine Co.
4709 Stenton Ave.
Philadelphia, Pa.
110 State St., Boston, Mass.
149 Broadway, New York City

GEARS



CULLMAN SPROCKETS

OVER 45,000 SPROCKETS CARRIED IN STOCK

Send for Catalog

CULLMAN WHEEL COMPANY
1339 Altgeld St. Chicago, Ill.

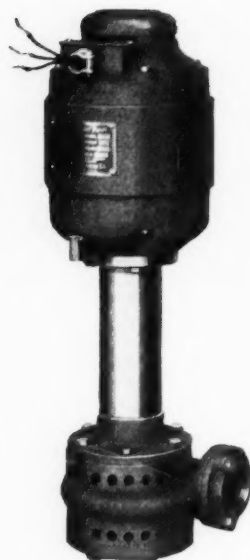


What the Well-Dressed Machine is Wearing

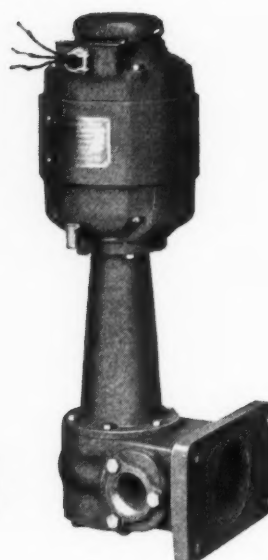
The style leaders in machine tool equipment are specifying Ruthman as coolant pump equipment. Knowing and approving the trend, machinery manufacturers are designing their products accordingly, and are prepared to furnish Ruthman Gusher Pump wherever specified.

Ruthmans are modern—with a minimum of wearing parts, simple and compact in design. They require no priming, have no packing nuts to leak, nor metal to metal contact. Specify Ruthman—and save!

THE RUTHMAN MACHINERY CO.
CINCINNATI, OHIO



Immersion Type
Model 11021

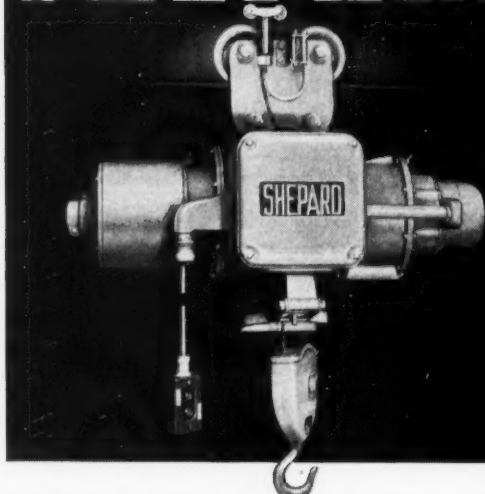


Outside Mounted Type
Model 11022

NOTE!

There are Ruthman Gusher Pumps for all requirements, in all sizes. We will be glad to make suggestions to your needs, without obligation, or send catalogs.

SHEPARD

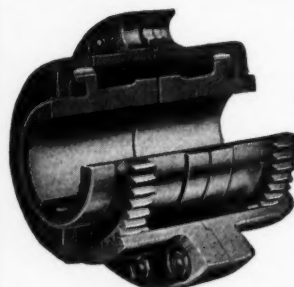


ELECTRIC HOISTS

Exclusive features: 1. Balanced Drive, at two points diametrically opposite. 2. Perfect alignment, maintained by all parts rotating around a common axis. 3. Automatic Oil Bath Lubrication. 4. Control by rope, push button, outrig or controller for every hoist. 5. Precision variable speed control for both A. C. and D. C. 6. Variety of speeds, types, lifts and capacities precisely suited to any service. Write for complete data.

SHEPARD NILES CRANE & HOIST CORP.
444 Schuyler Avenue, Montour Falls, N. Y.

POOLE Flexible Couplings



MADE TO ENDURE

NO Springs
Rubber
Die Castings
Pins
Bushings

POOLE Couplings are of the best grade forged steel made to rigid specifications.

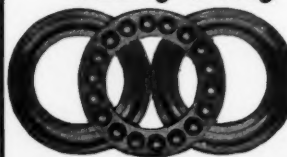
Send for Catalog M34.

POOLE FOUNDRY & MACHINE CO.

3701 Clipper Mill Rd.

Woodberry, Baltimore, Md.

Heavy Duty Thrust Bearings



Special Bearings, Made to Order
Any Quantity—One or One Thousand
Send Sketch or Sample for Quotation
Catalog Upon Request

The Gwilliam Company
360 Furman St. Brooklyn, N. Y.



Genuine PYROIL

Insure against friction hazards, with Pyroil. Sheathes all frictional areas with a glossy, slippery surface of "dry" lubrication which becomes virtually a part of the metal. Makes the metal SELF-LUBRICATING in emergencies. An ounce of Pyroil often saves many dollars. Write. Mfr'd. and Quat'd. by Pyroil Co., W. V. Kidder, Pres., 752 LaFollette Ave., LaCrosse, Wis., U. S. A.

BOOTH 27

MACHINE TOOL SHOW—CLEVELAND—SEPT. 11 TO 21

ON EXHIBIT

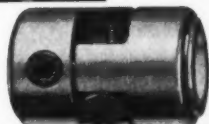
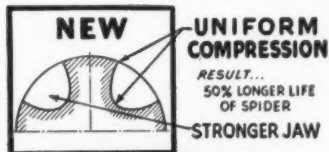
» » » *the full line of*
BROWN & SHARPE PUMPS
—for coolant—circulation
—hydraulic systems and
for lubrication

May we show you these
pumps at Booth 27?

Brown & Sharpe Mfg. Co.
Providence, R. I.



Brown & Sharpe Pumps
Geared — Vane — Centrifugal



MAXIMUM
COMPRESSION
MINIMUM
COMPRESSION



NEW L-R TYPE "IA" FLEXIBLE COUPLING

(U. S. and Foreign Patents Pending)

Has Longer Life

New convex or flaring surface design gives uniform compression, increases life of cushion 50%. Type "IA" made with bores $\frac{1}{4}$ " to 3" ($\frac{1}{4}$ H.P. to 300 H.P. at 1750 R.P.M.)—other types up to 10". L-R Couplings eliminate noise, last longer. They lower maintenance costs.

GET SAMPLE FOR TESTING
Just send Dia., H.P. and R.P.M.—we'll send test sample. No obligation. Write:

LOVEJOY TOOL WKS.
5021 West Lake St., Chicago, Ill.

"Smoother than Grease"
Since 1890



20 years without
a drink—

ARGUTO OILLESS BEARING CO.

Wayne Junction, Philadelphia, Pa.

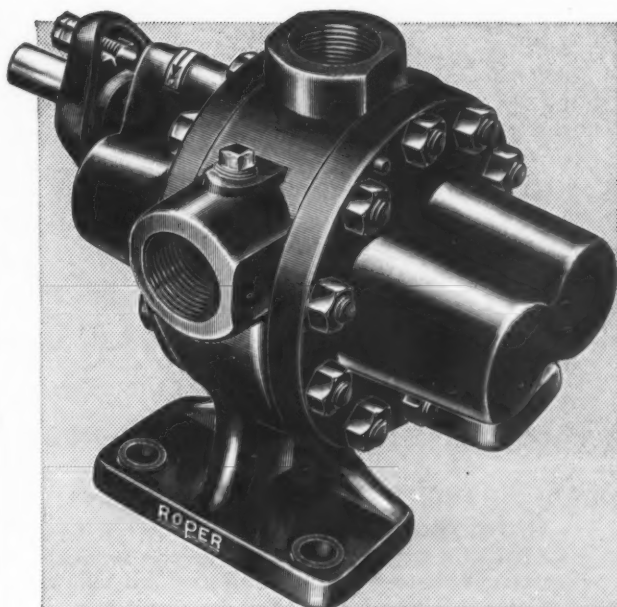


Fig. 999

ROTARY PUMPS

for Hydraulic Power Applications

• Full Ball Bearing Design

909 Series—Capacity, 10 to 50 G.P.M. (larger capacity if required). Pressure, 750 lbs.

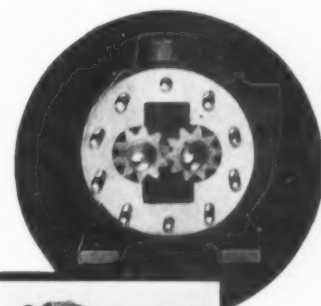
996 Series—Capacity, 4 to 200 G.P.M. (larger capacity if required). Pressure, 300 lbs.

• Sleeve Bearing Design

997 Series—Capacity, 80 to 700 G.P.M. Pressure, 100 lbs. (lubricating liquids) 40 lbs. (non-lubricating liquids).

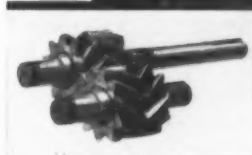
999 Series—Capacity, 1 to 500 G.P.M. Pressure, 100 lbs.

- Equal size gears operate at same speed.
- Accurately hobbed gears keyed and pressed on to shafts.
- Extra long large bearings.
- Carefully machined case.
- Rugged cast-iron construction.



Write for Bulletin R5M

GEO. D. ROPER CORP.
ROCKFORD, ILL., U. S. A.



ROPER Rotary pumps
DEPENDABLE—SINCE 1857

Bronze

BUSHINGS • BEARINGS

And Parts For All

MECHANICAL APPLICATIONS

BRONZE BUSHINGS AND BEARINGS

Made to blue print. Patterns and tools for over 30,000 designs placed free at the disposal of our customer. Engineering and metallurgical counsel without cost or obligation.

BUNTING BRONZE STANDARDIZED BEARINGS

Hundreds of sizes and types of completely machined and finished bronze bushings and bearings for all conceivable applications constantly carried in stock. Write for catalog.

HIGH-LEAD BRONZES

Special low-friction alloys for engine, compressor, pump and other bearing applications.

GRAPHITED OIL-LESS BRONZE BEARINGS

For all applications where the product restricts the use of lubricants.

SPECIAL DESIGNS AND ALLOYS

Our completely staffed engineering, metallurgical and research departments serve without cost or obligation all who desire aid in determining the most suitable bearing designs and alloys for special applications.

BRONZE WASHERS

Made from carefully controlled alloys to customer's specifications.

BRONZE CASTINGS

Plain and finished. Alloyed to customer's requirements.

BABBITT-LINED BRONZE-BACKED BEARINGS

Made to blue print for specific requirements.

BRONZE BARS CORED AND SOLID

Machined and centered, cast in 13-inch lengths. 121 sizes in stock. Available from all leading mill supply dealers.

BUNTING INDUSTRIAL BABBITT

A new and superior general purpose metal. Sold by all leading mill supply houses.

THE BUNTING BRASS & BRONZE COMPANY

The Largest Manufacturers of Bronze Bushings and Bearings in the World
TOLEDO, OHIO

Branches in All Principal Cities

BUNTING  **Quality**
PHOSPHOR BRONZE
BUSHINGS • BEARINGS
MACHINED AND CENTERED BRONZE BARS

SAFETY

SPEED

CONVENIENCE

FORD TRIBLOCS are safe—hold the loads indefinitely, without creeping. Speedy—because their finely cut spur gears are designed for efficiency. Convenient—because they work easily and reliably under all conditions. Durable—because they are made of certified malleable castings and drop forgings—with electrically welded high-carbon steel chain. All of which means they give economical service—by saving time and preventing mishaps through a long service life. The economy is even more impressive when their reasonable first cost is considered.

Ask your jobber's salesman. He will give you the story in full.

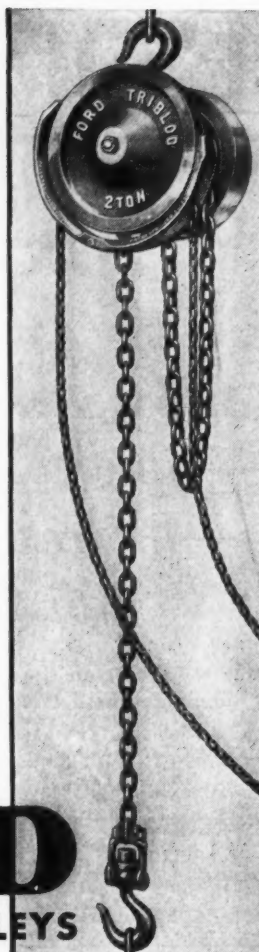
FORD CHAIN BLOCK CO.

An Associate Company
of the American Chain
Co., Inc., Philadelphia, Pa.



IN BUSINESS FOR YOUR SAFETY

FORD
TRIBLOCS AND TROLLEYS



MORGAN
CRANES

Modern Shop Transportation equipment that reduces costs of handling work speeds production by cutting "between operation" time. Complete line for all classes of work.

Send for a complete catalog of Morgan Cranes, Steam Hammers, Forging Presses, Shears, Hydraulic Presses, Mill Machinery.

MORGAN ENGINEERING COMPANY

NEW YORK

ALLIANCE, OHIO

PITTSBURGH



Face While Boring

M-D Facing Head can be attached to Column Boring Bar, and Drilling or Milling Machine spindles. Single point tool travels radially, from center outward or reverse, feeds automatically, and covers faces 6" to 30". Write for prices.

MUMMERT-DIXON COMPANY
HANOVER, PA.



EISLER SPOT WELDERS

½ TO 100 K. V. A.

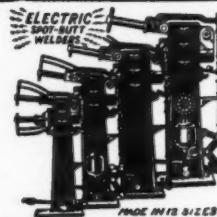
SAW BRAZING MACHINES, BUTT, WIRE, PORTABLE AND SPECIAL WELDERS

Welders as low as \$35.00

Submit Samples for Test. No obligations.

EISLER ENGINEERING CO., INC.

752 SO. 13th ST. NEWARK, N. J.
Dealers Wanted. Write Mr. Chas. Eisler, Pres.



WATERBURY STEEL BALLS

Waterbury steel balls are built for manufacturers who seek quality. Every ball is made of

**High Carbon
Chrome Alloy Steel**

This means *uniform* hardness right into the very center of the ball. Surface highly finished. No imperfections. Absolute precision.

High Carbon Chrome Alloy, Bronze, Monel Metal, Stainless Steel

Standard or Special
Sizes

Write for Information

THE WATERBURY STEEL BALL CO., Inc.
POUGHKEEPSIE, NEW YORK
Factory: Waterbury, Conn.



The Precision Universal Tool Head

A truly universal tool head that entirely displaces the old time wrench-adjusted offset boring head, as it not only bores but faces, undercuts, counterbores, recesses and turns outside diameters without a second's preparation or delay. All adjustments made without stopping tool or machine spindle, thus making routine work of difficult and unusual "headache" operations. One size handles all diameters up to 16". Super-accurate, rugged, compact. Unconditionally guaranteed. Send for bulletin.

THE PRECISION TOOL CO.
BRIDGEPORT, CONN.

ADJUSTABLE While Running!



We design and manufacture JIGS, FIXTURES, TOOLS DIES, SPECIAL MACHINES

THE COLUMBUS DIE, TOOL AND MACHINE CO.
COLUMBUS, OHIO

DRILL THESE HOLES



by a Quick, Easy,
Inexpensive Method.

Your business letterhead
will bring literature

Watts Bros. Tool Works
WILMERDING, PA.

BRONZE BEARING

performance



in AVIATION

THE EVER INCREASING use of Johnson Bronze Bushings and Bearings in the aircraft industry is definite proof of our ability to meet the precision requirements of this critical trade.

Bearing performance in an airplane is often a matter of life or death and only the highest quality obtainable is accepted.

Johnson Bronze has gained a reputation during the past quarter of a century for giving manufacturers bushings and bearings . . . **exactly according to specifications.** Here, your Bearing requirements receive the same careful attention . . . pass the same rigid inspection as those of the aircraft industry.

In addition to having complete facilities for the manufacture of every type of Bronze Bushing and Bearing, we also maintain a thoroughly competent staff of engineers and metallurgists ready and willing to aid you in the selection of the proper alloy . . . to determine the proper design. Why not submit your bearing problems to us? Our advice carries no obligation.

Write today.

Johnson Bronze Company

SOUTH MILL STREET
NEW CASTLE, PENNA.



FREE—Bulletin 340—Listing over 600 sizes
of Finished Bronze Bushings and Completely
Machined Bar Bronze. Write for your copy.

MACHINERY, August, 1935—91

HEADQUARTERS
FOR ALL TYPES OF
METAL WORKING MACHINERY—
STAMPING PRESSES—STRUCTURAL TOOLS

LOUIS E. **EMERMAN** AND COMPANY

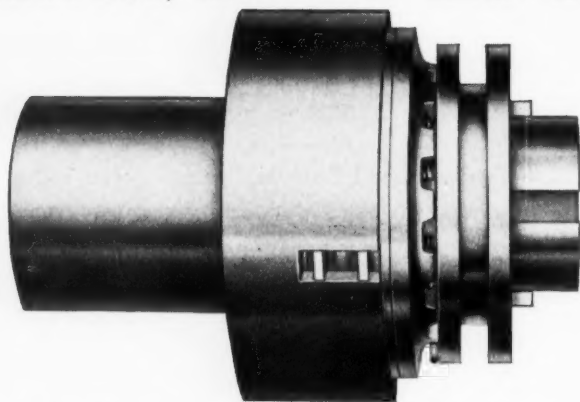
1761 ELSTON AVE. **CHICAGO** TEL. BRUNSWICK 4130

— Also FORGING EQUIPMENT — HYDRAULIC EQUIPMENT
— Our Stock is Large and Varied
— Our Prices Represent Real Values

SEND US YOUR INQUIRIES




THE NEW CONWAY (Series 800) SLEEVE CLUTCH



Another Development for Better Clutch Service . . .

A standard Conway Disc clutch especially designed for restricted swing radii and fractional horse powers—with all standard features as full floating plates, high ratio leverage, easy engagement, instant release and free idling. Can be furnished to operate dry or in oil; power factor can be increased with the limited addition of drive plates while retaining swing restrictions. This clutch can be operated in pairs for forward and reverse. Patent applied for.

Complete details in Bulletin XYZ

THE CONWAY CLUTCH COMPANY

1543 QUEEN CITY AVE., CINCINNATI, OHIO

COLTON HIGH SPEED TWIST DRILLS

will solve your drilling problems

"Black Devil"

KA-2 Bakelite Oil Hole
Gun Concave Special Spiral
Special and Standard Types
for all purposes

ARTHUR COLTON COMPANY

2618 Jefferson Ave., E.

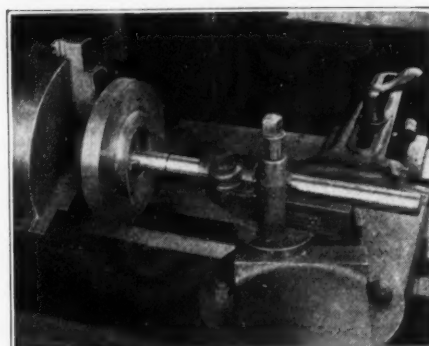
DETROIT, MICH.

ARMSTRONG



You
can't save on
**ARMSTRONG
TOOL
HOLDERS**

. . . you save
with them



When it comes to cutting costs, you can't save on ARMSTRONG TOOL HOLDERS. To try to do without the right one for each job, to "get-by" with makeshift or hand-forged tools, is certain to add to your costs.

With ARMSTRONG TOOL HOLDERS you are permanently tooled-up (time and tool cost saved); any mechanic can make or re-sharpen a cutter-bit in a few minutes ("dressing" delays eliminated, machine hours saved); each ounce of steel in a bit does the work of 10 ounces on a bar (steel consumption cut to 1/10); bits can be used down to the last inch (no waste in heavy tool "stumps"); and since each ARMSTRONG TOOL HOLDER is a multi-purpose tool that does the work of a complete set of forged tools, heavy investment in costly steels and high costs of storing and handling are ended.

If you are seriously interested in cutting cutting-costs to the absolute minimum, buy more ARMSTRONG TOOL HOLDERS . . . adopt the Armstrong System and "Save All Forging, 70% Grinding and 90% High Speed Steel" on every operation on every lathe, planer, slotter and shaper.

Write for Catalog



ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

313 N. Francisco Ave., CHICAGO, U. S. A.

New York Sales Office: 109 Lafayette Street

London Branch: ARMSTRONG BROS. TOOL CO., Ltd

Announcing

**A NEW PRESSURE
REDUCING VALVE and
PUMP GOVERNOR**

with only one moving part

**CRANKSHAFT MACHINE CO.
JACKSON, MICH., U. S. A.**

High Grade Used and Rebuilt Machine Tools

LATHES

48" Niles Heavy Car Wheel Lathe M.D.
42"x34" American Grd. Hd. S.P.D.
42"x30" Putnam Grd. Hd. S.P.D.
36"x18" American Grd. Hd. S.P.D.
36"x16" Lodge & Shipley Sel. Grd. Hd.
30"x18" American, 4 S.C.D. Bowl head.
30"x12" L&S Sel. Grd. Hd.
24"x16" American Grd. Hd. S.P.D.
20"x10" Bradford S.P.D. Grd. Hd.
20"x10" American Grd. Hd.
20"x30"17 Monarch Helical Grd. Hd. Gap. M.D.
18"x12" Lodge & Shipley S.P.D. Grd. Hd.
No. 2A Warner & Swasey, Univ. Tur.

RADIALLS AND UPRIGHT DRILLS

2 1/2", 3", 3 1/2", 6" Cintl. Bick. S.P.D.
3", 3 1/2", 4", 6" American Trip. Pur. Radials
S.P.D.
24" Cincinnati Bickford Upright, Tapping.
No. 40 Natche Straight Line Multiple.

GEAR CUTTERS AND HOBBERS

6", 11" & 18" Gleason Bevel Gear Generators.
No. 1 Schuchardt & Schutte.
18-H Gould & Eberhardt Hobbers.
No. 368M Gould & Eberhardt 3-sp. Gr. Rougher.
No. 4-48" Brown & Sharpe S.P.D.
No. 61, 615, 6 Fellows Gear Shapers.

BORING MILLS

72" Betts, Cone Drive.
60" Niles-Bement-Pond Vertical, 2 hds.
No. 35 Landis Floor type Mill.
24", 36" Bullard "New Era" Vertical.

SHAPERS AND PLANERS

16" 20" & 24" Gould & Eberhardt, high duty.
24" Cincinnati Shaper, Planer.
30"x30"x8" Cleveland Openside.
48"x48"x10" Cleveland Openside 3 hds. M.D.

MILLING MACHINES

No. 24 Brown & Sharpe.
No. 2 Rockford Univ. Cone.
No. 3 Ryerson S.P.D. Univ.
No. 3 LeBlond H.D. Plain.
No. 3 Kempnath Universal. Cone.
No. 4 Cintl. H.P. Plain. S.P.D.
3B Milwaukee Plain Miller, D.O.M. S.P.D.

GRINDERS

Nos. 50, 55, 60, 65 and 70 Healds.
No. 2 Brown & Sharpe Surface.
18"x96" Norton Grinder.
16"x48" Landis Crankshaft.
10"x52" Landis Self Contained.
6"x18" Landis Self Contained.

MISCELLANEOUS

1 1/2" Landis Bolt Cutter, Grd. Hd. M.D.
2 1/2" Landis Bolt Cutter, Lead Screw.
6" Landis Pipe Machine, M.D.
No. 43 Robinson Double Crank.
98-A Toledo S.S. Dble Crank.

If machines you need are not listed above, send us your inquiry. We have a very large stock.

Cincinnati Machinery & Supply Co.
29 West Second St., Cincinnati, Ohio

MILLERS

Nos. 2M and 4 Cincinnati rect. overarm, M.D.
No. 2 Milwaukee, Timken bearings, M.D.
No. 1 1/2, 2 and 3 Brown & Sharpe
No. 1404 Mil-Waukee-Mil duplex, Timken bearing, motor in base
24" and 48" Cincinnati plain automatic
24" and 48" Cincinnati duplex automatic
48" Ohio tilted offset
48" Newton continuous rotary
36" Ingersoll continuous rotary
48"x48"x8" Beaman & Smith openside
26"x24"x6" Ingersoll adjustable rail
No. 3 Cincinnati universal, S.P.D.
Nos. 4 and 6 Becker vertical
No. 3 Brown & Sharpe vertical

1500 Tools in Stock. Send for List.

MILES MACHINERY CO.
Saginaw, W.S., Mich.

FOR SALE

Bryant Tubular Gas Boiler
Nominal Rating, 1880 Low Pressure, Eleven Sections, Steam 4" Pipe, in Good Condition—Bargain.
Write E. C. Brown Company, Rochester, N. Y.

Equipped for Handling AUTOMATIC SCREW MACHINE PRODUCTS

Prices and delivery most satisfactory.
Write, Larson & Son, Screw Machine Products, Machine and Experimental Work, 205 Belden St., New Britain, Conn.

MODERN MACHINE TOOLS

GRINDERS

No. 72A3 Heald SizeMatic, two motor dr., latest
No. 3, 12, 30 Bryant, late
No. 20, 22 Heald Rotary Surface
No. 25 Heald Rotary Surface, hydraulic, M.D.
No. 2 Brown & Sharpe Automatic Surface
No. 2 Diamond Automatic Surface
No. 1, 2 Brown & Sharpe Universal
No. 13 Brown & Sharpe Universal and Tool
No. 11 Giddings & Lewis Teromatic, 3 M.D.
6x18", 10x24", 10x36", 12x36", 10x52",
16x52" Landis Plain Cylind. Self-Contained
No. 2—12x36" Cincinnati Universal
12x36" Cincinnati Plain
10x20" Landis Hydraulic Cylindrical
12x72" Landis Plain Cylindrical
16x72" Landis Crankshaft

MILLING MACHINES

No. 2, 3 Cincinnati Universal High Power, S.P.D.
No. 2, 3, 4 Cincinnati Vert. High Power, S.P.D.
18" Cincinnati Mfg., like new
24", 48" Cincinnati Duplex Automatic, M.D.
18", 24", 48" Cincinnati Plain Automatic, M.D.
No. 2, 3, 4, 5 Cincinnati Pl. High Pow., S.P.D.
No. 1 1/2, 2, 3 Cincinnati Universal, cone
No. 1 1/2, 2, 3, 4 Cincinnati Plain, cone
No. 1 1/2, 2, 3 Brown & Sharpe Universal, cone
No. 2 Kempnath Plain, cone
No. 4 Kempnath Vertical Maxi-Miller, M.D.
No. 3B, 4B Heavy, 5B Heavy Brown & Sharpe Plain, M.D., late
No. 4 Cincinnati Plain, rect. overarm, M.D.
No. 3 Rockford Rigidmill, M.D.
No. 21 Brown & Sharpe Automatic, S.P.D.

GEARED HEAD LATHES

14"x8" Reed-Prentice
18"x6" American, 12 speed
18"x8" American, 12 speed
18"x8" Lodge & Shipley, 12 speed
20"x6" Hendey
20"x8" American, 12 speed
20"x8" American, 8 speed
22"x14" Hendey
22"x14" Lodge & Shipley, 12 speed
24"x8" American, 12 speed, taper
30"x12" American, 12 speed
60"x29" Houston, Stanwood & Gamble, M.D.

DRILLS

No. 2, 4, 22 Colburn Mfg.
D2, D3, D4 Colburn H.D.
No. 121, 216, 217, 220, 310, 314, 315
Baker H.D.
4 spindle 22" Barnes Camel Back Self-Oiling
4 spindle No. 2 Colburn Mfg.
4 spindle No. 2 Avey-Matic
1, 4, 6 spindle No. 3 Avey, late
6 spindle No. 1/2 Avey, latest
6 spindle No. 2 Avey, power feed
4' Fostick Radial, gear box
3' American Triple Purpose Radial, M.D. thru gear box
3 1/2', 5', 6' Cincinnati-Bickford Rad., gear box
5' American Radial, gear box

20", 21", 24", 28", 36" Cincinnati-Bickford
Upright Drills
21", 24", 28", 32", 36" Aurora Upright Drills
20", 22", 28", 34" W. F. & John Barnes
Upright Drills
No. 1 1/2 Pratt & Whitney Gun Drill, M.D.
No. 30 Natche Multiple Drill, M.D.
No. 25 Bausch Multiple Drill, M.D.

GEAR MACHINERY

No. 34 Brown & Sharpe Gear Hobber
Hercules Gear Hobber, 6" cap.
No. 3, 12 Barber-Colman
No. 12 Barber-Colman, double overarm
No. 3, 4, 13 Brown & Sharpe Gear Cutters
No. 6, 61, 612 Fellows Gear Shapers
No. 5A Lees-Bradner Gear Generators
No. 11, 18" Gleason Gear Generators
No. 18H, 18HW Gould & Eberhardt Gear Hobbers
30" Ingle Gear Tooth Rounder

BORING MILLS

24", 36", 48" Bullard New Era, M.D.
30", 36", Gisholt Vertical, belt
37" Niles Vertical, M.D.
40", 52" King Vertical
72" Gisholt Vertical, M.D.
72" Niles Vertical, belt
72" Bickford Vertical, belt
No. 0 Fostick Horizontal, 3 1/4" bar
Cleveland Horizontal, 2 1/2" bar
Rockford Horizontal

TURRET LATHES, MFG. LATHES

No. 2A, 3A, Warner & Swasey Universal, bar
No. 2A, 3A, Warner & Swasey Universal chuck'g.
No. 1, 2, 4, 6, 8 Warner & Swasey Turret
No. 4 Warner & Swasey Universal
No. 5A, 6A, 7A Potter & Johnston Automatic
No. 6D Potter & Johnston Automatic
No. 4, 7 Bardons & Oliver Turret
No. 23, 24 New Britain Automatic
No. 9 LeBlond Multi-Cut
Pratt & Whitney Turret
Dreses Turret
21"x10" LeBlond Mfg.
3 1/4"x36" Acme Universal Geared Head Turret
Lathe, M.D.

PRESSES

No. 26 Stoll Horning
No. 2 Adriance O.B.I.
No. 1/2 Toledo O.B.I.
No. 3 Michigan O.B.I.
No. 2, 3 Robinson O.B.I.
No. 3 Toledo O.B.I.
No. 6 Waterbury-Farrel Double Crank
No. 32P, 35 Toledo Stiles Type
851 Ferracute Double Crank
No. 54A Toledo Special
No. 83C Michigan Double Crank Geared
No. 90E Toledo Double Crank
No. 92 1/2 O Toledo Double Crank Geared
No. 94 Bliss Consolidated

Write for complete stock list.

THE EASTERN MACHINERY CO. 3267 SPRING GROVE AVE.
CINCINNATI, OHIO

MACHINE SHOP AND BUILDING FOR RENT OR SALE

A building of the following specifications with machine shop equipment, located in Northern Ohio, can be rented or bought:

Brick and steel construction.

105' wide, 149' long and 51' high.

Mezzanine running length of building 38' wide.

Traveling crane with 60' span, 15 ton capacity, 40' headroom.

Good cement floor with large floor plates.

Spur NKP RR into building.

Good heating plant.

Complete machine shop equipment listed below:

BORING MILL
PLANER
LATHES

DRILL PRESSES
SHAPERS
RADIAL DRILLS
MILLING MACHINES

Complete tool crib.

Building and equipment in good repair.

Office building adjacent.

Now being occupied by machinery builder.

Good labor and raw material sources.

Low taxes, favorable insurance rates.

Address Box No. 116, care MACHINERY, 148 Lafayette St., New York.

MACHINERY'S PRODUCT INDEX

FOR LOCATION OF ADVERTISEMENTS OF MANUFACTURERS LISTED IN THIS INDEX SEE ALPHABETICAL INDEX, PAGE 112

ABRASIVE CLOTH AND PAPER

Behr-Manning Corp., Div. Norton Co., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Walls Sales Corp., 96 Warren St., New York, N. Y.

ACCUMULATORS, HYDRAULIC

Morgan Engineering Co., Alliance, O.

AIR HOISTS

See Hoists, Air.

AIR TOOLS

See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

ALLOYS, STEEL, TUNGSTEN, VANADIUM, MANGANESE, ETC.

Carboloy Co., Inc., Detroit, Mich.
Carpenter Steel Co., Reading, Pa.
Haynes Steelite Co., Kokomo, Ind.
Illinois Steel Co., 208 S. La Salle St., Chicago, Ill.
Ludlum Steel Co., Watervliet, N. Y.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

ALLOYS, ZINC

New Jersey Zinc Co., 160 Front St., New York City.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.

ARBOR PRESSES

See Presses, Arbor

ARBORS AND MANDRELS, EXPANDING AND SOLID

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill.

Jacobs Mfg. Co., Hartford, Conn.
McCroskey Tool Corp., Meadville, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.

Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

BABBITT

Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.

BALANCING EQUIPMENT

Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.

BALLS, BRASS, STEEL, ETC.

Gwilliam Co., 360 Furman St., Brooklyn, N. Y.
S K F Industries, Inc., Philadelphia, Pa.
Waterbury Steel Ball Co., Inc., Poughkeepsie, N. Y.

BAR, BORING

See Boring Bars.

BAR, PHOSPHOR BRONZE

Bunting Brass & Bronze Co., Toledo, O.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

BAR, STEEL

Carnegie Steel Co., Pittsburgh, Pa.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.

BEARINGS, BABBITT

Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., Chicago.

BEARINGS, BALL

Bantam Ball Bearing Co., South Bend, Ind.
Boston Gear Works, Inc., North Quincy, Mass.

EX-CELL-O AIRCRAFT & TOOL CORP., DETROIT, MICH.

Fafnir Bearing Co., New Britain, Conn.
Federal Bearing Co., Inc., Poughkeepsie, N. Y.
Gwilliam Co., 360 Furman St., Brooklyn, N. Y.

Marlin-Rockwell Corp., Jamestown, N. Y.

New Departure Mfg. Co., Bristol, Conn.

Norma-Hoffmann Bearings Corp., Stamford, Conn.

Schatz Mfg. Co., Poughkeepsie, N. Y.

S K F Industries, Inc., Philadelphia, Pa.

Torrington Co., Torrington, Conn.

BEARINGS, BRONZE AND SPECIAL ALLOYS

Bunting Brass & Bronze Co., Toledo, O.
Haynes Steelite Co., Kokomo, Ind.
Johnson Bronze Co., New Castle, Pa.
Morgan Engineering Co., Alliance, O.

BEARINGS, LINESHAFT

Fafnir Bearing Co., New Britain, Conn.
Hyatt Roller Bearing Co., Newark, N. J.
Link-Belt Co., Chicago.
Shafer Bearing Corp., 6519 W. Grand Ave., Chicago.
S K F Industries, Inc., Philadelphia, Pa.

BEARINGS, OILLESS

Arguto Oilless Bearing Co., 145 Berkley St., Wayne Junction, Philadelphia.

BEARINGS, QUILL

Bantam Ball Bearing Co., South Bend, Ind.

BEARINGS, ROLLER

Bantam Ball Bearing Co., South Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Gwilliam Co., 360 Furman St., Brooklyn, N. Y.

Hyatt Roller Bearing Co., Newark, N. J.

Norma-Hoffmann Bearings Corp., Stamford, Conn.

Shafer Bearing Corp., 6519 West Grand Ave., Chicago.

S K F Industries, Inc., Philadelphia, Pa.

Timken Roller Bearing Co., Canton, O.

BEARINGS, TAPERED ROLLER

Bantam Ball Bearing Co., South Bend, Ind.

Timken Roller Bearing Co., Canton, O.

BEARINGS, THRU

Bantam Ball Bearing Co., South Bend, Ind.

Boston Gear Works, Inc., North Quincy, Mass.

Fafnir Bearing Co., New Britain, Conn.

General Electric Co., Schenectady, N. Y.

Gwilliam Co., 360 Furman St., Brooklyn, N. Y.

Norma-Hoffmann Bearings Corp., Stamford, Conn.

Shafer Bearing Corp., 6519 W. Grand Ave., Chicago.

S K F Industries, Inc., Philadelphia, Pa.

Timken Roller Bearing Co., Canton, O.

BELT FASTENERS, METAL, LEATHER, ETC.

Bristol Co., Waterbury, Conn.
Greene, Tweed & Co., 109 Duane St., New York City.

BELTS, V-

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

BELT LACING

Bristol Co., Waterbury, Conn.

BELT SHIFTERS

Haskins, R. G., Co., 4634 Fulton St., Chicago.

LeBlond, R. K., Machine Tool Co., Cincinnati, O.

Ready Tool Co., Bridgeport, Conn.

BENCH LEGS

New Britain Gridley Machine Co., New Britain, Ct.

Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, ANGLE IRON

Consolidated Machine Tool Corporation of America, Rochester, N. Y.

BENDING MACHINES, HYDRAULIC

Morgan Engineering Co., Alliance, O.

BLOCKS, CHAIN

See Hoists, etc.

BLOWERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

American Gas Furnace Co., Elizabeth, N. J.

Candey-Otto Mfg. Co., Chicago Heights, Ill.

General Electric Co., Schenectady, N. Y.

Leiman Bros., Inc., Newark, N. J.

Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

BOILER TUBES

National Tube Co., Pittsburgh, Pa.

Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.

BOLT AND NUT MACHINERY

Acme Machinery Co., Cleveland.

Landis Mch. Co., Inc., Waynesboro, Pa.

BOOKS, TECHNICAL

Industrial Press, 148 Lafayette St., New York.

BOOSTERS

American Gas Furnace Co., Elizabeth, N. J.

BORING AND DRILLING MACHINES, VERTICAL

Baker Brothers, Inc., Toledo, O.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

Barnes, W. F., & John Co., Rockford, Ill.

Bullard Co., Bridgeport, Conn.

Gisholt Machine Co., Madison, Wis.

Gorton, Geo., Machine Co., 1109 13th St., Racine, Wis.

Link-Belt Co., Chicago.

Moline Tool Co., Moline, Ill.

Rockford Drilling Machine Co., Rockford, Ill.

BORING AND TURNING MILLS, VERTICAL

Bullard Co., Bridgeport, Conn.

Consolidated Machine Tool Corporation of America, Rochester, N. Y.

Gisholt Machine Co., Madison, Wis.

BORING BARS

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.

Bullard Co., Bridgeport, Conn.

Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.

Gisholt Machine Co., Madison, Wis.

Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

Lovejoy Tool Co., Inc., Springfield, Vt.

Madison Mfg. Co., Muskegon, Mich.

Ready Tool Co., Bridgeport, Conn.

Williams, J. H., & Co., 75 Spring St., New York City.

BORING, DRILLING AND MILLING MACHINES, HORIZONTAL

Barnes, W. F., & John Co., Rockford, Ill.

Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago.

Consolidated Machine Tool Corporation of America, Rochester, N. Y.

Landis Tool Co., Waynesboro, Pa.

Rockford Drilling Machine Co., Rockford, Ill.

Universal Boring Machine Co., Hudson, Mass.

BORING HEADS

Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.

Precision Tool Co., Bridgeport, Conn.

BORING MACHINES, DIAMOND AND CARBIDE TOOL

Automatic Machine Co., Bridgeport, Conn.

Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich.

Heald Machine Co., Worcester, Mass.

Stokerunit Corp., Milwaukee, Wis.

BORING MACHINES, JIG

Pratt & Whitney Co., Hartford, Conn.

BORING TOOLS

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.

Carboloy Co., Inc., Detroit, Mich.

Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.

Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

Lovejoy Tool Co., Inc., Springfield, Vt.

Morse Twist Drill & Machine Co., New Bedford, Mass.

Ready Tool Co., Bridgeport, Conn.

Union Twist Drill Co., Athol, Mass.

Williams, J. H., & Co., 75 Spring St., New York City.

BRACKS, AUTOMATIC FOR POWER PRESSES

Swaine, Fred J., Manufacturing Co., St. Louis, Mo.

BRACKS, PRESS AND BENDING

Schatz Mfg. Co., Poughkeepsie, N. Y.

BRASS AND COPPER

Revere Copper and Brass Inc., 230 Park Ave., New York, N. Y.

BRAZING EQUIPMENT

American Gas Furnace Co., Elizabeth, N. J.

BROACHES

Carboloy Co., Inc., Detroit, Mich.

Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich.

Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.

Oilgear Co., Milwaukee, Wis.

BROACHING MACHINES

Cincinnati Milling Machine Co., Oakley, Cincinnati.

Foot-Burr Co., Cleveland, O.

Oilgear Co., Milwaukee, Wis.

V & O Press Co., Hudson, N. Y.

BRONZE

Bunting Brass & Bronze Co., Toledo, O.

Johnson Bronze Co., New Castle, Pa.

Morgan Engineering Co., Alliance, O.

Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

BUFFERS

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.

New Britain Gridley Machine Co., New Britain, Ct.

BULLDOZERS

Schatz Mfg. Co., Poughkeepsie, N. Y.

BURNERS, GAS AND OIL

American Gas Furnace Co., Elizabeth, N. J.

Leiman Bros., Inc., Newark, N. J.

BURNISHING MACHINERY

Baird Machine Co., Bridgeport, Conn.

BUSHINGS, BRASS, BRONZE, ETC.

Boston Gear Works, Inc., North Quincy, Mass.

Bunting Brass & Bronze Co., Toledo, O.

Haynes Steelite Co., Kokomo, Ind.

Johnson Bronze Co., New Castle, Pa.

Morgan Engineering Co., Alliance, O.

BUSHINGS, HARDENED

Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.

Danly Machine Specialties, Inc., 2112 South 52nd Ave., Chicago, Ill.

Leland-Gifford Co., Worcester, Mass.

BUSHINGS, JIG

Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich.

Universal Engineering Co., Frankenthum, Mich.

CABINETS, TOOL

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.

Morse Twist Drill & Machine Co., New Bedford, Mass.

CALIPERS

Brown & Sharpe Mfg. Co., Providence.

Starrett, L. S., Co., Athol, Mass.

CAMS

Hartford Special Mchry. Co., Hartford, Conn.

Rowbottom Machine Co., Waterbury, Conn.

CASE-HARDENING

American Gas Furnace Co., Elizabeth, N. J.

American Metal Treatment Co., Elizabeth, N. J.

Williams, J. H., & Co., 75 Spring St., New York City.

CASE-HARDENING FURNACES

See Furnaces, Heat Treating

CASTINGS, BRASS, BRONZE AND ALUMINUM

Morgan Engineering Co., Alliance, O.

CASTINGS, DIE OR PERMANENT MOLD

Superior Die Casting Co., Cleveland.

CASTINGS, GRAY IRON

Brown & Sharpe Mfg. Co., Providence.

Link-Belt Co., Chicago.

CASTINGS, MALLEABLE

Timken Roller Bearing Co., Canton, O.

Link-Belt Co., Chicago.

CEMENT, DISC GRINDING WHEEL

Walls Sales Corp., 96 Warren St., New York, N. Y.

CENTERING MACHINES

Hanson-Whitney Machine Co., Hartford, Conn.

Pratt & Whitney Co., Hartford, Conn.

Sundstrand Machine Tool Co., Rockford, Ill.

CENTERS, LATHE

Haynes Steelite Co., Kokomo, Ind.

Modern Machine Corp., 285 N. 6th St., Brooklyn, N. Y.

Ready Tool Co., Bridgeport, Conn.

PRECISION

Better machines, with longer life, better performance, lower operating and maintenance cost—this is Industry's demand. And **better** machines must have **better** bearings. * Economy is a matter of performance, not of first cost alone. Actual records, made under diverse and difficult conditions, are the one safe guide in appraising serviceability and value—whether in machines or in machine bearings. * Norma-Hoffmann **Precision Bearings** stand in the fore-front, on their distinguished record of over 20 years—showing that "they cost the least per year of service." * Write for the Catalog, showing a **Precision Bearing** for every load, speed and duty. Let our engineers work with yours.

1. Open (separable) type ball bearing
2. Closed, radial type ball bearing
3. Angular contact ball bearing
4. Plate (shielded) ball bearing—closed on one or both sides
5. "GreaSeal" 7000 Series felt-protected ball bearing
6. Double-row self-aligning ball bearing
7. Standard cylindrical roller bearing
8. Ball thrust bearings—available in all types

BEARINGS

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.



HARDNESS TESTING

For a fast Non-destructive test and 100% Portability—the latest improved **SCLEROSCOPE** (International Standard). Used the world over. Exact conversions to Brinell now available.

For a Static Test determining Qualitative and Quantitative hardness in all, including Super-hard Materials—the **MONOTRON**. Best for Sub-surface and Non-destructive Testing. Fastest Testing Machine now on the market and in wide use.

Descriptive Bulletins Free on Application.

The Shore Instrument & Manufacturing Co.

9025 Van Wyck Ave.
JAMAICA, N. Y.



**DIAL INDICATORS AND
PRECISION MEASURING
INSTRUMENTS**
FEDERAL PRODUCTS CORP.
PROVIDENCE, R. I.

Branches: NEW YORK, DETROIT, CHICAGO, MUNCIE, CLEVELAND

Every Shop Needs These Rugged, Accurate, Portable Pyrometers

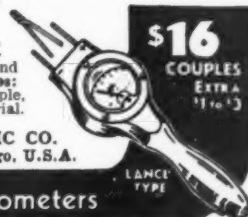
L88 for checking Surface Temperatures: 800° range, with 1 ft. silver tip couple, \$17.90. L89 for Non-ferrous Metals: 1600° range, with 2 ft. couple and 1 ft. replaceable tip, \$19.30. L90 for furnaces: 2500° range, with 3 ft. couple, \$19.00. Sent on 30-Day Trial.

Circular Free



RUSSELL ELECTRIC CO.
354 W. Huron St., Chicago, U.S.A.

Hold-Heat Pyrometers



\$16
COUPLES
EXTRA
1/10-1/2

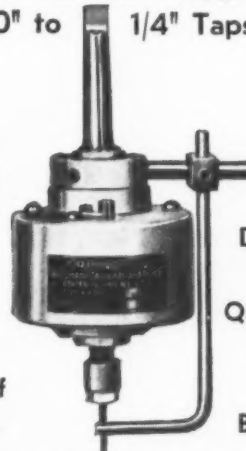
ERRINGTON HY-SPD Super-Sensitive BALL BEARING

No. 00—CONE-DRIVE

2 to 1 Auto-Reverse Tapping Chuck

0" to 1/4" Taps

Combination
Bronze & Ball
Bearings
Thru-Out
—
Easy and
Economical
Replacement of
Cone-Clutches



Depth-Gauge
facilitates
Quick-Handling,
Especially
on
Bottom-Holes

The principle on which this Style is designed is especially effective on very small tapping.

See General Price List for other
Styles and Sizes up to 2" Pipe Tapping

Errington Mechanical Laboratory
Main Office and Works, STATEN ISLAND, New York

Chicago Office:
6047 N. Talman Ave.

New York Office:
200 Broadway

Boston Office:
830 Old South Bldg.

Morse Twist Drill & Machine Co., New Bedford, Mass.
 National Twist Drill & Tool Co., Detroit, Mich.
 Standard Tool Co., Cleveland, O.
 Watts Bros. Tool Wks., Wilmerding, Pa.
CHUCKS, FULL FLOATING
 Errington Mechanical Laboratory, 200 Broadway, New York
 Gisholt Machine Co., Madison, Wis.
 Watts Bros. Tool Wks., Wilmerding, Pa.
CHUCKS, LATHE, ETC.
 Bullard Co., Bridgeport, Conn.
 Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
 McCrosky Tool Corp., Meadville, Pa.
 Rivett Lathe & Grinder Inc., Brighton, Boston, Mass.
CHUCKS, MAGNETIC
 Heald Machine Co., Worcester, Mass.
 Walker, O. S. Co., Inc., Worcester, Mass.
CHUCKS, QUICK CHANGE AND SAFETY
 Errington Mechanical Laboratory, 200 Broadway, New York
 Geometric Tool Co., New Haven, Conn.

Jarvis, Chas. L. Co., Gildersleeve, Ct.
 McCrosky Tool Corp., Meadville, Pa.
CHUCKS, RING WHEEL
 Graham Mfg. Co., Providence, R. I.
CHUCKS, TAPPING
 Barber-Colman Co., Rockford, Ill.
 Errington Mechanical Laboratory, 200 Broadway, New York
 Jacobs Mfg. Co., Hartford, Conn.
 Jarvis, Chas. L. Co., Gildersleeve, Ct.
 McCrosky Tool Corp., Meadville, Pa.
 Watts Bros. Tool Wks., Wilmerding, Pa.
CLAMPS
 Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago
 Danly Machine Specialties, Inc., 2112 South 52nd Ave., Chicago, Ill.
 Starrett, L. S. Co., Athol, Mass.
 Williams, J. H. & Co., 75 Spring St., New York City
CLEANERS, CHEMICAL FOR WASTE AND METAL
 Oakite Products, Inc., 26 Thames St., New York City

CLUTCHES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
 Conway Clutch Co., Cincinnati, Ohio
 Link-Belt Co., Chicago
 Morse Chain Co., Ithaca, N. Y.
 Production Mch. Co., Greenfield, Mass.
 Rockford Drilling Mch. Co., Rockford, Ill.
 Twin Disc Clutch Co., Racine, Wis.

COLLARS, SAFETY

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.
 Link-Belt Co., Chicago
 Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence
 Cleveland Twist Drill Co., Cleveland, O.
 Geometric Tool Co., New Haven, Conn.
 Pratt & Whitney Co., Hartford, Conn.
 Standard Tool Co., Cleveland, O.
 Union Twist Drill Co., Athol, Mass.

COLLETS, SPRING

Ames, B. O. Co., Waltham, Mass.
 Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
 Rivett Lathe & Grinder Inc., Brighton, Boston, Mass.

COMPARATORS, SCREW THREAD

Jones & Lamson Machine Co., Springfield, Vt.

COMPOUND, CLEANING

Oakite Products, Inc., 26 Thames St., New York City

COMPOUND, CUTTING, GRINDING, ETC.

Oakite Products, Inc., 26 Thames St., New York City
 Sun Oil Co., Philadelphia

COMPRESSORS, AIR

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 General Electric Co., Schenectady, N. Y.

CONTRACT WORK

Automatic Machine Co., Bridgeport, Ct.
 Columbus Die, Tool & Machine Co., Columbus, O.
 Dieffendorf Gear Corp., Syracuse, N. Y.
 Gisholt Machine Co., Madison, Wis.
 Hartford Special Machinery Co., Hartford, Conn.
 Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
 Langeller Mfg. Co., Providence, R. I.
 LeBlond, R. K., Machine Tool Co., Cincinnati, O.
 Modern Machine Corp., 285 N. 6th St., Brooklyn, N. Y.
 Morgan Engineering Co., Alliance, O.
 Mummet-Dixon Co., Hanover, Pa.
 New Britain Gridley Machine Co., New Britain, Ct.
 Pratt & Whitney Co., Hartford, Conn.
 Ruthman Machinery Co., 534-536 E. Front St., Cincinnati, O.
 Taylor-Shantz Co., Rochester, N. Y.
 U. S. Tool Co., Inc., Amper, N. J.
 V & O Press Co., Hudson, N. Y.

CONTROLLERS

Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis.
 Bristol Co., Waterbury, Conn.
 General Electric Co., Schenectady, N. Y.
 Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

CONVEYOR ROLLS, ROLLER BEARING

Shafer Bearing Corp., 6519 W. Grand Ave., Chicago

CONVEYORS, BELT

Link-Belt Co., Chicago
 Wickwire Spencer Steel Co., 41 E. 42nd St., New York

COPPER AND BRASS

Revere Copper and Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES

Carboloy Co., Inc., Detroit, Mich.
 Cleveland Twist Drill Co., Cleveland, O.
 Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich.
 Haynes Stellite Co., Kokomo, Ind.
 Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
 Morse Twist Drill & Machine Co., New Bedford, Mass.
 National Twist Drill & Tool Co., Detroit, Mich.
 Pratt & Whitney Co., Hartford, Conn.
 Standard Tool Co., Cleveland, O.
 Starrett, L. S. Co., Athol, Mass.
 Union Twist Drill Co., Athol, Mass.

COUNTERSHAFTS

Brown & Sharpe Mfg. Co., Providence
 Diamond Machine Co., Providence, R. I.
 Gisholt Machine Co., Madison, Wis.
 Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago

LeBlond, R. K., Machine Tool Co., Cincinnati, O.

COUNTERSINKS

Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich.
 Greenfield Tap & Die Corp., Greenfield, Mass.
 Union Twist Drill Co., Athol, Mass.

COUNTERS, REVOLUTION

Bristol Co., Waterbury, Conn.
 Starrett, L. S. Co., Athol, Mass.

COUNTING DEVICES

Bristol Co., Waterbury, Conn.
 Starrett, L. S. Co., Athol, Mass.
 Veeder-Root, Inc., Hartford, Conn.

COUPLERS, HOSE

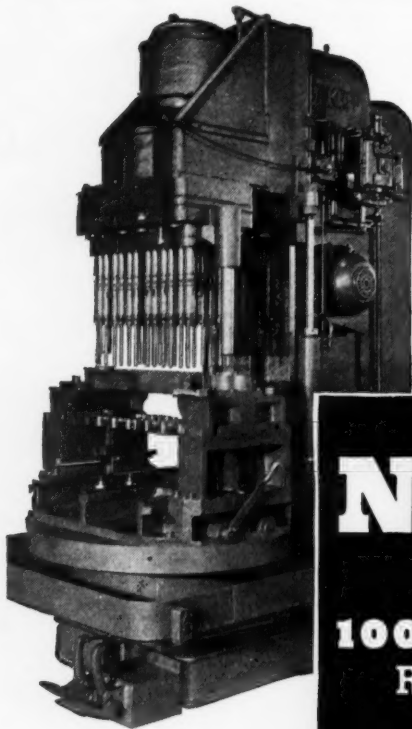
Greene, Tweed & Co., 109 Duane St., New York City

COUPLINGS, FLEXIBLE

Baldwin-Duckworth Chain Corp., Worcester and Springfield, Mass.
 Boston Gear Works, Inc., North Quincy, Mass.
 Link-Belt Co., Chicago
 Lovejoy Tool Wks., 5021 W. Lake St., Chicago
 Morse Chain Co., Ithaca, N. Y.
 Philadelphia Gear Works, Philadelphia
 Pools Fdry. & Mch. Co., Baltimore, Md.

COUPLINGS, SHAFT

Boston Gear Works, Inc., North Quincy, Mass.
 Link-Belt Co., Chicago



Get this big new book, **FREE**—Atleft, Baker No. 30-HO Machine, Oilgear Fluid Power Feed-equipped.



NEW FLUID POWER FEEDS

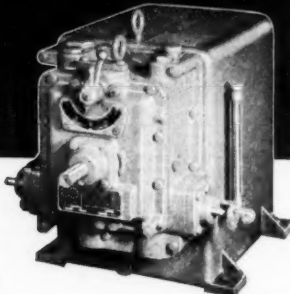
100 to 600% More Rapid Traverse Speed

Up to 50% Lower Cost

Compensated

For Speed Variations Under Temperature and Working Conditions

Get Oilgear's Big New Book. Free, of Course



NEWS! News for machinery designers, sellers and buyers! The new Oilgear Fluid Power Feeds bring new speed, new smoothness, and new low cost. You should have the facts. Get them, in Oilgear's big new book. The OILGEAR Company, 1310 W. Bruce St., Milwaukee, Wisconsin.

Shown here: New Oilgear Fluid Power Feed. Note flanged mounting, as integral machine part... Inside pump, eliminating hazard and improving

appearance... Self-contained; auxiliary valves and tubing are integral with pump... Many other exclusive features.

OILGEAR FLUID POWER FEEDS

(B-3500)

"WE STILL LOOK FOR NEW IDEAS"

"Only a short time ago we were having trouble with our cutting compound. It was gumming up some big turret lathes, turning rancid and giving off an unpleasant odor.

"While we were figuring out what to do, an Oakite Service Man recommended a change to Oakite Cutting Compound. We hadn't heard of this material. But what he told us seemed sound and we tried it. Result? Machine, tool and work now stay clean. The compound does not go sour. Improved cooling and lubrication permit higher cutting speeds."

It pays to watch out for new ideas. Ask us about new Oakite materials for such operations as cutting, grinding, rust-proofing, and paint-stripping.

Manufactured only by
OAKITE PRODUCTS, INC., 26 Thames St., NEW YORK, N. Y.

OAKITE

Industrial Cleaning Materials and Methods



INDUSTRY'S ACCEPTED STANDARD OF CLEANING SINCE 1909



COMPARE

Turning pressure in setting up a Bristo Screw is direct. That is, it is circumferential. It follows the clockwise direction in which the screw turns. Consequently there is no rounding out of the socket, no slipping, no fumbling as would be inevitable with side-wall pressure,—particularly in the smaller sizes. The Bristo Company, Waterbury, Connecticut.



BRISTO

REG. U. S. PAT. OFF.

SOCKET HEAD SET AND CAP SCREWS

2 NEW IDEAS in FLAT-DRAWER FILING

—are explained and illustrated in the New Supplement to Hamilton Catalog No. 10-MA. If you haven't seen this helpful booklet, ask your dealer for a copy or mail the convenient coupon.



HAMILTON MANUFACTURING CO.
Two Rivers, Wisconsin

HAMILTON

Drafting Room FURNITURE

HAMILTON MFG. CO., Two Rivers, Wis.

Please send Supplement to your Catalog No. 10-MA.

Name

Firm Name

Address.....

City..... State..... MA-8/35

MACHINERY, August, 1935—97

CRANES, ELECTRIC TRAVELING
Link-Belt Co., Chicago.
Morgan Engineering Co., Alliance, O.
Shepard Niles Crane & Hoist Corp.,
444 Schuyler Ave., Montour Falls,
N. Y.

CRANES, HAND TRAVELING
Shepard Niles Crane & Hoist Corp.,
444 Schuyler Ave., Montour Falls,
N. Y.

CRANES, LOCOMOTIVE
Link-Belt Co., Chicago.

CRANES, PORTABLE
Candey-Otto Mfg. Co., Chicago Heights,
Ill.

CRANK PIN TURNING MACHINES
Crankshaft Machine Co., Jackson, Mich.
Lodge & Shipley Machine Tool Co.,
Cincinnati.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence.
Ex-Cell-O Aircraft & Tool Corp., De-
troit, Mich.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

CUTTERS, MILLING
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
Carboloy Co., Inc., Detroit, Mich.
Cleveland Twist Drill Co., Cleveland, O.
Columbus Die, Tool & Machine Co.,
Columbus, O.

Consolidated Mch. Tool Corp. of Amer-
ica, Rochester, N. Y.
Ex-Cell-O Aircraft & Tool Corp., De-
troit, Mich.
Gorton, Geo., Machine Co., 1109 13th
St., Racine, Wis.
Haynes Stellite Co., Kokomo, Ind.
Illinois Tool Works, 2501 North Keeler
Ave., Chicago, Ill.
Lovejoy Tool Co., Inc., Springfield, Vt.
Morse Twist Drill & Machine Co., New
Bedford, Mass.
National Twist Drill & Tool Co., De-
troit, Mich.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

CUTTING COMPOUNDS
See Compounds, Cutting, Grinding, etc.

CUTTING-METALS OR ALLOYS
Carboloy Co., Inc., Detroit, Mich.

CUTTING-OFF MACHINES, ABRASIVE WHEEL
Armstrong Brothers Tool Co., 313 N.
Francisco Ave., Chicago.

CUTTING-OFF MACHINES, COLD SAW
See Sawing Machines, Circular.

CUTTING-OFF MACHINES
Automatic Machine Co., Bridgeport, Ct.
Brown & Sharpe Mfg. Co., Providence.
Landis Mch. Co., Inc., Waynesboro, Pa.

CUTTING-OFF TOOLS
Armstrong Brothers Tool Co., 313 N.
Francisco Ave., Chicago.
Haynes Stellite Co., Kokomo, Ind.
Pratt & Whitney Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Williams, J. H. & Co., 75 Spring St.,
New York City.

CYLINDER BORING MACHINES
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., 814 Chestnut St.,
Rockford, Ill.
Consolidated Mch. Tool Corp. of Amer-
ica, Rochester, N. Y.

DEALERS, MACHINERY
Cincinnati Machinery & Supply Co.,
Cincinnati.
Earle Gear & Mch. Co., 4709 Stenton
Ave., Philadelphia.
Eastern Machinery Co., Cincinnati, O.
Miles Machinery Co., Saginaw, Mich.
Ryerson, Joseph T. & Son, Inc., 2558
W. 16th St., Chicago, Ill.

DEMAGNETIZERS
Heald Machine Co., Worcester, Mass.
Walker, O. S., Co., Inc., Worcester,
Mass.

DESIGNERS, MACHINE AND TOOL
Hartford Special Machinery Co., Hart-
ford, Conn.
Manufacturers' Consulting Engineers,
Syracuse, N. Y.
Ruthman Machinery Co., 534-536 E.
Front St., Cincinnati, O.

DIAMONDS AND DIAMOND TOOLS
Desmond-Stephan Mfg. Co., Urbana, O.

DIE BLOCKS
Ludlum Steel Co., Watervliet, N. Y.

DIE CASTING MACHINES
Madison-Kipp Corp., Madison, Wis.

DIE CASTINGS
See Castings, Die or Pneumatic Mold.

DIE MAKERS' SUPPLIES

Baumbach, E. A., Mfg. Co., 1810 S.
Kilbourn Ave., Chicago.
Danly Machine Specialties, Inc., 2112
South 52nd Ave., Chicago, Ill.
U. S. Tool Co., Inc., Ampere, N. J.

DIE MAKING MACHINES
Oliver Instrument Co., 1410 E. Mau-
mee St., Adrian, Mich.

DIE SETS, STANDARD

Baumbach, E. A., Mfg. Co., 1810 S.
Kilbourn Ave., Chicago.
Danly Machine Specialties, Inc., 2112
South 52nd Ave., Chicago, Ill.
U. S. Tool Co., Inc., Ampere, N. J.

DIE SINKING MACHINES

Gorton, Geo., Machine Co., 1109 13th
St., Racine, Wis.
Pratt & Whitney Co., Hartford, Conn.
Preis Engraving Machine Co., 157 Sum-
mit St., Newark, N. J.

DIE STOCKS

See Stocks, Die.

DIES, SHEET METAL, ETC.

Baumbach, E. A., Mfg. Co., 1810 S.
Kilbourn Ave., Chicago.
Columbus Die, Tool & Machine Co.,
Columbus, O.
Danly Machine Specialties, Inc., 2112
South 52nd Ave., Chicago, Ill.
Haynes Stellite Co., Kokomo, Ind.
Modern Machine Corp., 285 N. 6th St.,
Brooklyn, N. Y.

Niagara Mch. & Tool Works, Buffalo,
N. Y.

Ruthman Machinery Co., 534-536 E.
Front St., Cincinnati, O.

Taylor-Shantz Co., Rochester, N. Y.

U. S. Tool Co., Inc., Ampere, N. J.

V. & O. Press Co., Hudson, N. Y.

Waltham Mch. Wks., Waltham, Mass.

DIES, THREADING

Butterfield Div., Union Twist Drill Co.,
Derby Line, Vt.

Card, S. W., Mfg. Co., Mansfield, Mass.

Eastern Machine Screw Corp., New
Haven, Conn.

Geometric Tool Co., New Haven, Conn.

Greenfield Tap & Die Corp., Greenfield,
Mass.

H & G Works, Eastern Machine Screw
Corp., New Haven, Conn.

Hardinge Bros., Inc., 1418 College Ave.,
Elmira, N. Y.

Jones & Lamson Machine Co., Spring-
field, Vt.

Landis Mch. Co., Inc., Waynesboro, Pa.

Morse Twist Drill & Machine Co., New
Bedford, Mass.

Murphy Mch. & Tool Co., 951 Porter
St., Detroit, Mich.

Pratt & Whitney Co., Hartford, Conn.

Standard Tool Co., Cleveland, O.

DIES, THREADING, OPENING

Butterfield Div., Union Twist Drill Co.,
Derby Line, Vt.

Consolidated Mch. Tool Corp. of Amer-
ica, Rochester, N. Y.

Eastern Mch. Screw Corp., New Haven,
Conn.

Errington Mechanical Laboratory, 200
Broadway, New York.

Geometric Tool Co., New Haven, Conn.

H & G Works, Eastern Machine Screw
Corp., New Haven, Conn.

Jones & Lamson Machine Co., Spring-
field, Vt.

Landis Mch. Co., Inc., Waynesboro, Pa.

Murphy Mch. & Tool Co., 951 Porter
St., Detroit, Mich.

DIES, THREAD ROLLING

Hanson-Whitney Machine Co., Hartford,
Conn.

DISCS, ABRASIVE

Carborundum Co., Niagara Falls, N. Y.

Norton Co., Worcester, Mass.

Walls Sales Corp., 96 Warren St.,
New York, N. Y.

DOWEL PINS

Baumbach, E. A., Mfg. Co., 1810 S.
Kilbourn Ave., Chicago

Danly Machine Specialties, Inc., 2112
South 52nd Ave., Chicago, Ill.

DRAFTING MACHINES

Drafto Co., Cochran, Pa.

DRAWING BOARDS AND TABLES

Drafto Co., Cochran, Pa.

Hamilton Mfg. Co., Two Rivers, Wis.

DRESSERS, GRINDING WHEEL

Bridgeport Safety Emery Wheel Co.,
Inc., 1283 W. Broad St., Bridge-
port, Conn.

Calder, Geo. H., Lancaster, Pa.

Carboloy Co., Inc., Detroit, Mich.

Desmond-Stephan Mfg. Co., Urbana, O.

Norton Co., Worcester, Mass.

Ransom Grinding Machine Co., Osh-
kosh, Wis.

Standard Tool Co., Cleveland, O.

DRIFTS, DRILL

Armstrong Brothers Tool Co., 313 N.
Francisco Ave., Chicago.

DRILL HEADS, MULTIPLE

Baker Brothers, Inc., Toledo, O.

Barnes Drill Co., 814 Chestnut St.,
Rockford, Ill.

New De Luxe HANDEE Grinder



Sensational ELECTRIC TOOL

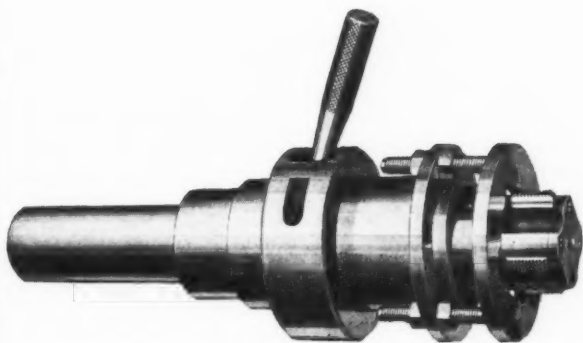
... Nothing else like it. New design—modern materials—revolutionary performance. With a speed of 25,000 r.p.m. and ample power, this compact, easy-to-handle production tool does 1001 jobs with astounding savings in time and labor.

Will not heat in continuous service. Weighs 12 ounces. 6" long, 1 5/8" in diameter. Fastest and most powerful portable tool for its weight and type ever developed. Price, \$18.50, complete with 6 Chicago Mounted Wheels. 10 Days' Trial.

Ask Your Supply House for Demonstration
or Write for More Detailed Information

CHICAGO WHEEL & MFG. COMPANY

114 South Aberdeen Street, Chicago, Ill.



This is the Murchey Type "C" Collapsible Machine and Pipe Top, for Hand Screw Machines, Turret Lathes or, by removing the handle, for Drill Presses and Rotary Spindle Machines. Collapsing is positive—no chaser binding. Chasers may be removed without removing cap. This top can be equipped with overhanging chasers to cut close to a shoulder or for a blind hole, and can be constructed to include boring, reaming and chamfering tools, and with any type pilot. Sizes, 1-1/4" to 12" incl. Catalogs.

Murchey

—for Fine Threads

There is a Murchey Tap for every thread cutting operation—right in design and outstanding in performance.

Whether it's a tool-room or production job, a Murchey Tap will assure the finest results at the lowest cost. They prolong chaser life, and cut better threads.

THE MURCHEY MACHINE & TOOL CO.
951 Porter Street, Detroit, Mich.

Foreign Agents: Coats Machine Tool Co., Ltd., Coastal Chambers, 15 Elizabeth St., Westminster, London, S.W.1, Eng.

MURCHEY



Furnaces

for every industrial requirement

American Gas Furnace Co.
Elizabeth, New Jersey

"HEAT-EASY" Compound

Prevents Scaling and Distortion in Hardening
HIGH SPEED STEEL

Also, we do Skilled Hardening and Heat-Treating of every kind, and guarantee the results

THE BENNETT METAL TREATING COMPANY, Elmwood, Conn.



UNIVERSAL

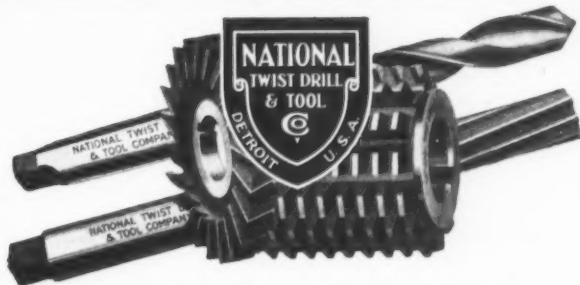
A. S. A. STANDARD
DRILL BUSHINGS
—AND—

COLLET CHUCKS
FOR END MILLS

KEYWAY CUTTERS and
NITRIDED CENTER POINTS



UNIVERSAL ENGINEERING CO.
FRANKENMUTH MICHIGAN



TWIST DRILLS, REAMERS, HOBS,
MILLING CUTTERS, SPECIAL TOOLS

NATIONAL TWIST DRILL & TOOL CO.
DETROIT, U. S. A.

Tap & Die Division—WINTER BROS. CO., WRENTHAM, MASS.

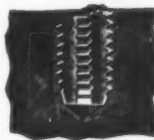
COMMERCIAL HEAT TREATING



Case Hardening—Nitriding—
Hardening—Tempering—Anneal-
ing—Gun Metal Coloring, Etc.

American Metal Treatment Co.
Elizabeth New Jersey

A WALTON TAP EXTRACTOR CAN SAVE THE PIECE



Remove the broken tap easily and quickly
with a Walton. It saves the piece—and
also the thread. All sizes—3/16" to 1 1/4";
other sizes to order. Write for a catalog.

THE WALTON COMPANY
92 ALLYN ST., HARTFORD, CONN.

Buhr Machine Tool Co., Ann Arbor, Mich.
Errington Mechanical Laboratory, 200 Broadway, New York.
Langellier Mfg. Co., Providence, R. I.
Rockford Drilling Mch. Co., Rockford, Ill.

DRILL SOCKETS

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

Morse Twist Drill & Machine Co., New Bedford, Mass.

National Twist Drill & Tool Co., Detroit, Mich.

Standard Tool Co., Cleveland, O.

Union Twist Drill Co., Athol, Mass.

DRILL SPEEDERS

Graham Mfg. Co., Providence, R. I.

DRILL STANDS

Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Standard Tool Co., Cleveland, O.

Union Twist Drill Co., Athol, Mass.

DRILLING MACHINES, AUTOMATIC

Baker Brothers, Inc., Toledo, O.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

Barnes, W. F., & John Co., Rockford, Ill.

Buhr Machine Tool Co., Ann Arbor, Mich.

Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.

Langellier Mfg. Co., Providence, R. I.

Ames, B. C. Co., Waltham, Mass.

Barnes, W. F., & John Co., Rockford, Ill.

Canedy-Otto Mfg. Co., Chicago Heights, Ill.

Delta Mfg. Co., 3775 No. Holton St., Milwaukee, Wis.

Dumore Company, Racine, Wis.

Langellier Mfg. Co., Providence, R. I.

LeBlond, R. K., Machine Tool Co., Cincinnati, O.

Leland-Gifford Co., Worcester, Mass.

Rockford Drilling Mch. Co., Rockford, Ill.

DRILLING MACHINES, BOILER

Footo-Burt Co., Cleveland, O.

DRILLING MACHINES, GANG

Baker Brothers, Inc., Toledo, O.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

Barnes, W. F., & John Co., Rockford, Ill.

Canedy-Otto Mfg. Co., Chicago Heights, Ill.

Footo-Burt Co., Cleveland, O.

Langellier Mfg. Co., Providence, R. I.

Leland-Gifford Co., Worcester, Mass.

Moline Tool Co., Moline, Ill.

Rockford Drilling Mch. Co., Rockford, Ill.

DRILLING MACHINES, HORIZONTAL DUPLEX

Barnes, W. F., & John Co., Rockford, Ill.

Langellier Mfg. Co., Providence, R. I.

Murphy Mch. & Tool Co., 951 Porter St., Detroit, Mich.

Rockford Drilling Mch. Co., Rockford, Ill.

Sundstrand Machine Tool Co., Rockford, Ill.

DRILLING MACHINES, MULTIPLE SPINDLE

Baker Brothers, Inc., Toledo, O.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

Barnes, W. F., & John Co., Rockford, Ill.

Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago.

Buhr Machine Tool Co., Ann Arbor, Mich.

Canedy-Otto Mfg. Co., Chicago Heights, Ill.

Consolidated Mch. Tool Corp. of America, Rochester, N. Y.

Footo-Burt Co., Cleveland, O.

Greenlee Bros. & Co., Rockford, Ill.

Langellier Mfg. Co., Providence, R. I.

Leland-Gifford Co., Worcester, Mass.

Moline Tool Co., Moline, Ill.

Pratt & Whitney Co., Hartford, Conn.

Rockford Drilling Mch. Co., Rockford, Ill.

DRILLING MACHINES, RADIAL

Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago.

Canedy-Otto Mfg. Co., Chicago Heights, Ill.

Carlton Machine Tool Co., Cincinnati, Ill.

DRILLING MACHINES, RAIL

See heading Drilling Machines, Gang.

DRILLING MACHINES, SENSITIVE

Barnes, W. F., & John Co., Rockford, Ill.

Canedy-Otto Mfg. Co., Chicago Heights, Ill.

Footo-Burt Co., Cleveland, O.

Hardinge Bros. Inc., 1418 College Ave., Elmira, N. Y.

Langellier Mfg. Co., Providence, R. I.

Leiman Bros. Inc., Newark, N. J.

Leland-Gifford Co., Worcester, Mass.

Manufacturers' Consulting Engineers, Syracuse, N. Y.

Moline Tool Co., Moline, Ill.

Pratt & Whitney Co., Hartford, Conn.

Rockford Drilling Mch. Co., Rockford, Ill.

Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

DRILLING MACHINES, UPRIGHT

Baker Brothers, Inc., Toledo, O.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

Barnes, W. F., & John Co., Rockford, Ill.

Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago.

Canedy-Otto Mfg. Co., Chicago Heights, Ill.

Consolidated Mch. Tool Corp. of America, Rochester, N. Y.

Delta Mfg. Co., 3775 No. Holton St., Milwaukee, Wis.

Footo-Burt Co., Cleveland, O.

Langellier Mfg. Co., Providence, R. I.

Leland-Gifford Co., Worcester, Mass.

Rockford Drilling Mch. Co., Rockford, Ill.

Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

DRILLING MACHINES, WALL RADIAL

Canedy-Otto Mfg. Co., Chicago Heights, Ill.

DRILLS, CENTER

Cleveland Twist Drill Co., Cleveland, O.

Greenfield Tap & Die Corp., Greenfield, Mass.

Morse Twist Drill & Machine Co., New Bedford, Mass.

National Twist Drill & Tool Co., Detroit, Mich.

Pratt & Whitney Co., Hartford, Conn.

Standard Tool Co., Cleveland, O.

Union Twist Drill Co., Athol, Mass.

DRILLS, CORE

Carboloy Co., Inc., Detroit, Mich.

Morse Twist Drill & Machine Co., New Bedford, Mass.

Union Twist Drill Co., Athol, Mass.

DRILLS, PORTABLE ELECTRIC

Chicago Wheel & Mfg. Co., 114 So. Aberdeen St., Chicago, Ill.

Dumore Company, Racine, Wis.

Errington Mechanical Laboratory, 200 Broadway, New York.

Haskins, R. G., Co., 4634 Fulton St., Chicago.

Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

White S. S. Dental Mfg. Co., 150 W. 42nd St., New York, N. Y.

DRILLS, RATCHET

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.

Cleveland Twist Drill Co., Cleveland, O.

Greene, Tweed & Co., 109 Duane St., New York City.

Greenfield Tap & Die Corp., Greenfield, Mass.

Morse Twist Drill & Machine Co., New Bedford, Mass.

National Twist Drill & Tool Co., Detroit, Mich.

Pratt & Whitney Co., Hartford, Conn.

Standard Tool Co., Cleveland, O.

Union Twist Drill Co., Athol, Mass.

DRILLS, SQUARE AND HEXAGON

Watts Bros. Tool Wks., Wilmerding, Pa.

DRILLS, TWIST

Carboloy Co., Inc., Detroit, Mich.

Cleveland Twist Drill Co., Cleveland, O.

Colton, Arthur Co., 2618 Jefferson Ave., E. Detroit, Mich.

Greenfield Tap & Die Corp., Greenfield, Mass.

Morse Twist Drill & Machine Co., New Bedford, Mass.

National Twist Drill & Tool Co., Detroit, Mich.

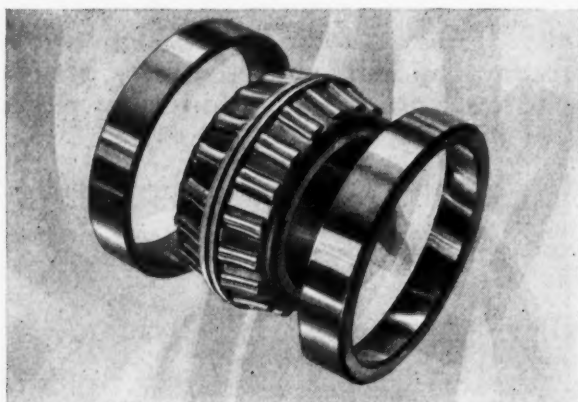
Pratt & Whitney Co., Hartford, Conn.

Standard Tool Co., Cleveland, O.

Union Twist Drill Co., Athol, Mass.

DRILLS, WIRE

Union Twist Drill Co., Athol, Mass.



Why SHAFAER delivers better Roller Bearing Performance

- Because the Shafer CONCAVE roller design provides a natural self-aligning action within the bearing itself.
- Because only the Shafer Bearing design combines—Radial-thrust roller bearing capacity—Integral self-alignment—Simple adjustability.
- Because misalignment, shaft deflection, shock loads, or inaccuracies of installation do not affect Shafer Bearing performance. The automatic self-alignment maintains full radial-thrust load capacity plus free-rolling action . . . always.

All these Shafer Bearing advantages are available for industrial applications in convenient, compact stock units, offered in a full range of sizes. Consult Shafer engineers, or write for catalog 12.

SHAFAER BEARING CORPORATION
6519 West Grand Avenue Chicago, Illinois



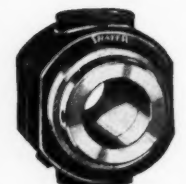
All the performance features in a single compact unit



Flange Unit



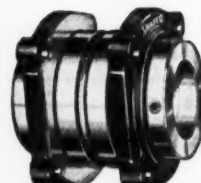
Take-up Unit



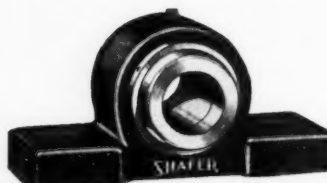
Hanger Box



Cartridge Unit



Duplex Unit

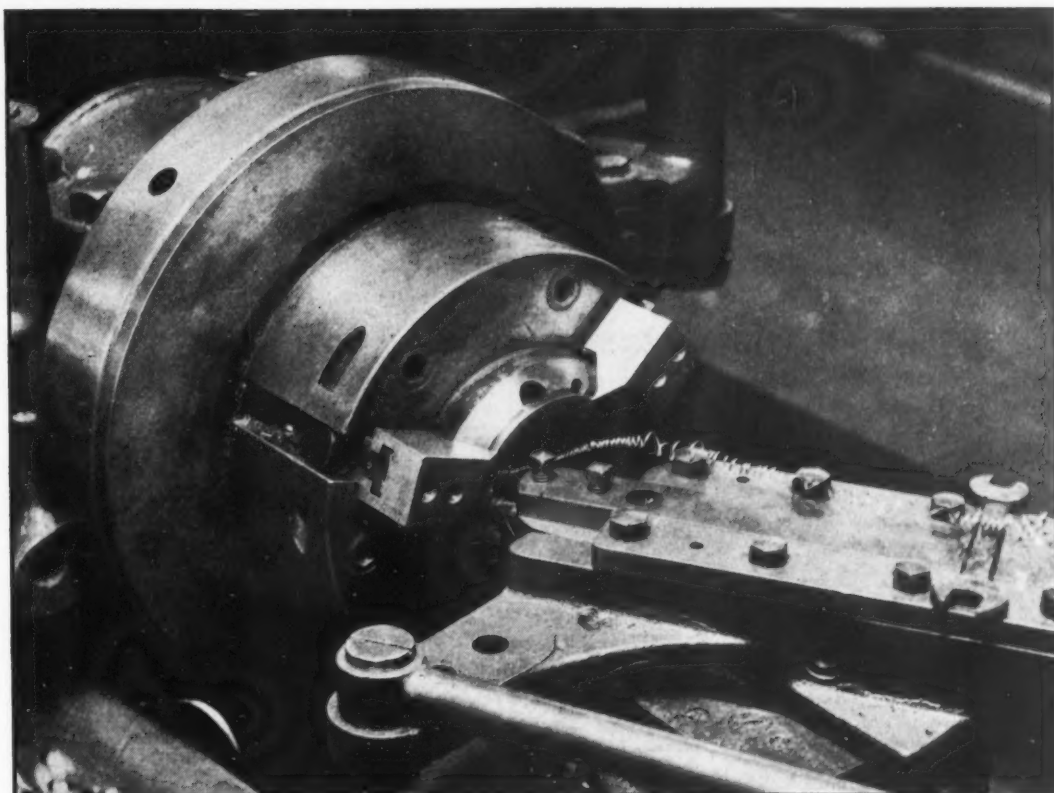


Pillow Block

BETTER THAN DAYLIGHT

Banish Reject Costs

WITH THIS DETAIL-REVEALING LIGHT



Holes, inside threads, even the shadows, are luminous when the lights are Cooper-Hewitts. Glare from polished metal surfaces is eliminated, and scratches are detected without trouble. Cooper-Hewitts enable workers to turn out uniformly better work . . . and maintain first-hour efficiency throughout a shift.

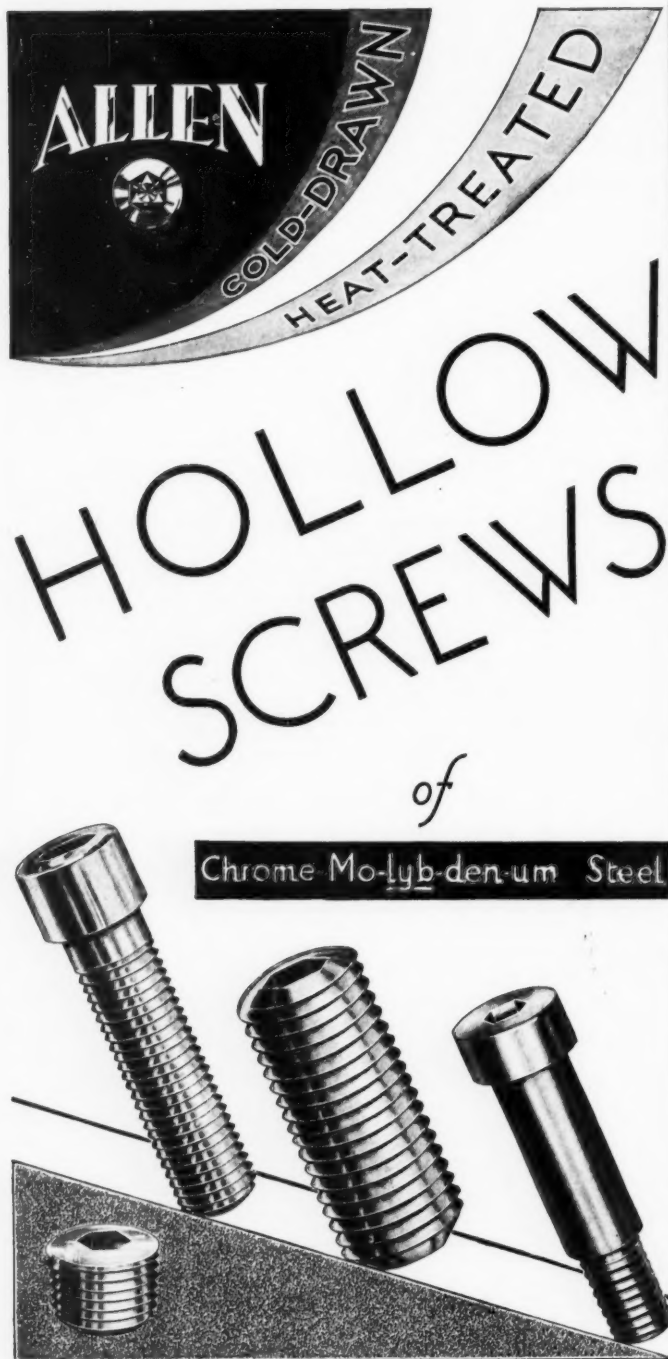
Cooper-Hewitts provide the proper *intensity* of light and the right *quality* of light to provide the maximum in modern lighting comfort. Workers do not have to waste energy in "seeing" . . . for their eyes respond very rapidly and easily to mercury vapor light.

More than sixty different industries have reduced rejects and lowered production costs by using this modern "production tool." The resultant saving in eye fatigue and reduction of accidents in the plant make Cooper-Hewitts truly a profit-producing investment.

Try Cooper-Hewitts on your most difficult lighting job and bear in mind that their operating cost is no more than that of other light of equal intensity. Get full details from any representative . . . Write General Electric Vapor Lamp Company, 893 Adams Street, Hoboken, New Jersey.

GENERAL  ELECTRIC
VAPOR LAMP COMPANY

648 Copr. 1934, General Electric Vapor Lamp Co.



Hollow Screws look much alike but "ALLENS" and others aren't made alike — which explains why they don't ACT alike under critical stresses and strains.

Cold-drawing the sockets of Allen screws avoids bending or spreading the fibres of the metal — whereas bending, spreading or stretching the fibres weakens the structure of the steel by breaking the cohesion of the fibre bundle.

Allen cold-drawing packs the fibres of steel more closely together; increases cohesion and density of the metal; compresses more strength into a given diameter of screw.

There's only ONE make of cold-drawn screws — but that one's made in large enough quantities to satisfy all who would like to get them and save trouble by using them.

THE ALLEN MFG. COMPANY
HARTFORD, CONN. U. S. A.

DRIVE SCREWS, SELF-TAPPING
Parker-Kalon Corp., 200 Varick St., New York.

ELECTRICAL EQUIPMENT
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

ELEVATORS
Link-Belt Co., Chicago.

EMERY WHEELS
See Grinding Wheels.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel.

ENGINEERS, CONSULTING MECHANICAL
Manufacturers' Consulting Engineers, Syracuse, N. Y.

ENGRAVING MACHINES
Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Pratt & Whitney Co., Hartford, Conn.
Preis Engraving Machine Co., 157 Summit St., Newark, N. J.

FANS, EXHAUST, ELECTRIC VENTILATING
General Electric Co., Schenectady, N. Y.

FEEDS FOR PUNCH PRESSES, AUTOMATIC
Littell, F. J., Mch. Co., 4125 Ravenswood Ave., Chicago.

FERRO ALLOYS
New Jersey Zinc Co., 160 Front St., New York City.

FILES
Nicholson File Co., Providence, R. I.
FILING MACHINES, DIE, ETC.
Ames, B. C. Co., Waltham, Mass.
Haskins, R. G., Co., 4634 Fulton St., Chicago.

ILLINOIS TOOL WORKS, 2501 North Keeler Ave., Chicago, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS FOR GRINDING AND HONING COMPOUNDS
Fostoria Pressed Steel Corp., Fostoria, O.

FLEXIBLE SHAFT EQUIPMENT
Errington Mechanical Laboratory, 200 Broadway, New York.

HASKINS, R. G., Co., 4634 Fulton St., Chicago.
Jarvis, Chas. L., Co., Gildersleeve, Conn.

OLIVER INSTRUMENT CO., 1410 E. MAUMEE ST., ADRIAN, MICH.
White, S. S., Dental Mfg. Co., 150 W. 42nd St., New York, N. Y.

FORGES
American Gas Furnace Co., Elizabeth, N. J.
Canedy-Otto Mfg. Co., Chicago Heights, Ill.

FORGING MACHINES
Acme Mfg. Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

FORGINGS, BRASS
Revere Copper and Brass Inc., 230 Park Ave., New York, N. Y.

FORGINGS, DROP
Williams, J. H., & Co., 75 Spring St., New York City.

FORGINGS, IRON AND STEEL
Morgan Engineering Co., Alliance, O.

FORGINGS, UPSET
Williams, J. H., & Co., 75 Spring St., New York City.

FORMING AND BENDING MACHINES
Niagara Machine & Tool Wks., Buffalo, N. Y.

FOUNDRY EQUIPMENT
Link-Belt Co., Chicago.
New Britain Gridley Machine Co., New Britain, Ct.

FURNACES, HARDNESS
Leeds & Northrup Co., Philadelphia, Pa.

FURNACES, HEAT-TREATING ELECTRIC
General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.

FURNACES, HEAT-TREATING OIL, GAS, ETC.
American Gas Furnace Co., Elizabeth, N. J.

FURNITURE, DRAFTING ROOM
Hamilton Mfg. Co., Two Rivers, Wis.
New Britain Gridley Machine Co., New Britain, Ct.

GAGE STANDARDS
Ford Motor Co. (Johansson Div.), Detroit, Mich.

GAGES, COMPARATOR
Federal Products Corp., Providence.
Jones & Lamson Machine Co., Springfield, Vt.

GAGES, DEPTH
Brown & Sharpe Mfg. Co., Providence.
Starrett, L. S., Co., Athol, Mass.

GAGES, DIAL
Ames, B. C. Co., Waltham, Mass.

Brown & Sharpe Mfg. Co., Providence.
Federal Products Corp., Providence.
Starrett, L. S., Co., Athol, Mass.
Taylor-Shantz Co., Rochester, N. Y.

GAGES, HEIGHT
Brown & Sharpe Mfg. Co., Providence.
Starrett, L. S., Co., Athol, Mass.

GAGES, PLUG, RING AND SNAP
Brown & Sharpe Mfg. Co., Providence.
Cleveland Twist Drill Co., Cleveland, O.

EX-CELL-O Aircraft & Tool Corp., Detroit, Mich.
Ford Motor Co. (Johansson Div.), Detroit, Mich.

GREENFIELD TAP & DIE CORP., GREENFIELD, MASS.
Haynes Stellite Co., Kokomo, Ind.

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASS.
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S., Co., Athol, Mass.

TAYLOR-SHANTZ CO., ROCHESTER, N. Y.
GAGES, RECORDING, STEAM VACUUM
Bristol Co., Waterbury, Conn.

GAGES, SURFACE
Brown & Sharpe Mfg. Co., Providence.
Columbus Die, Tool & Machine Co., Columbus, O.

STARRETT, L. S., CO., ATHOL, MASS.
Taylor-Shantz Co., Rochester, N. Y.

GAGES, TAPER
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S., Co., Athol, Mass.

GAGES, THREAD
Bath, John & Co., Inc., Worcester, Mass.

BROWN & SHARPE MFG. CO., PROVIDENCE.
Federal Products Corp., Providence.
Ford Motor Co. (Johansson Div.), Detroit, Mich.

GREENFIELD TAP & DIE CORP., GREENFIELD, MASS.
Hanson-Whitney Machine Co., Hartford, Conn.

JONES & LAMSON MACHINE CO., SPRINGFIELD, VT.
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S., Co., Athol, Mass.

GASKETS
Garlock Packing Co., Palmyra, N. Y.
Greene, Tweed & Co., 109 Duane St., New York City.

GEAR BLANKS, NON-METALLIC
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GEAR CUTTING MACHINES, BEVEL (GENERATOR AND TEMPLET PLANNER)
Bilgram Gear & Machine Works, 1217-35 Spring Garden St., Philadelphia.

GEAR CUTTING MACHINES, BEVEL AND SPUR (ROTARY CUTTER)
Brown & Sharpe Mfg. Co., Providence.
Waltham Mch. Wks., Waltham, Mass.

GEAR CUTTING MACHINES, HELICAL AND SPUR (HOB)
Barber-Colman Co., Rockford, Ill.

BROWN & SHARPE MFG. CO., PROVIDENCE.
GEAR CUTTING MACHINES, HELICAL AND SPUR (SHAPER OR PLANNER TYPE)
Fellows Gear Shaper Co., Springfield, Vt.

GEAR CUTTING MACHINES, WORMS AND WORM WHEELS (HOB)
Barber-Colman Co., Rockford, Ill.

GEAR TESTING MACHINERY
Brown & Sharpe Mfg. Co., Providence.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.

MANUFACTURERS' CONSULTING ENGINEERS, SYRACUSE, N. Y.
Morse Twist Drill & Machine Co., New Bedford, Mass.

GEARS, CUT
Automatic Machine Co., Bridgeport, Ct.
Bilgram Gear & Machine Works, 1217-35 Spring Garden St., Philadelphia.

BOSTON GEAR WORKS, INC., NORTH QUINCY, MASS.
Brown & Sharpe Mfg. Co., Providence.

CINCINNATI GEAR CO., CINCINNATI.
Cullman Wheel Co., 1339 Altgeld St., Chicago, Ill.

DIEFENDORF GEAR CORP., SYRACUSE, N. Y.
Earle Gear & Mch. Co., 4709 Stenton Ave., Philadelphia.

FELLOWS GEAR SHAPER CO., SPRINGFIELD, VT.
General Electric Co., Schenectady, N. Y.

GRANT GEAR WORKS, INC., BOSTON, MASS.
Hartford Special Mch. Co., Hartford, Conn.

LINK-BELT CO., CHICAGO.
Massachusetts Gear & Tool Co., 34 Nashua St., Woburn, Mass.

PERKINS MACHINE & GEAR CO., SPRINGFIELD, MASS.
Philadelphia Gear Works, Philadelphia.

POOLS FRY & MCH. CO., BALTIMORE, MD.
Sier-Bath Co., 640 West 58th Street, New York.

STAHL GEAR & MACHINE CO., CLEVELAND.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.



CARD QUALITY

COMMERCIAL GROUND THREAD TAPS

Consistently Producing Class 2 Fit

PRECISION GROUND THREAD TAPS

For the Most Accurate Threads

CUT THREAD TAPS

For Commercial Threads

Three classes—developed by experts for all classes of tapping. Card Commercial Ground Thread Taps—more accurate than cut thread taps at little greater cost. A slight change in thread specifications frequently makes it possible to use them instead of more expensive precision taps, greatly reducing tap costs.

Card Taps—sold by leading dealers everywhere. Send for Catalog 33 listing the entire line.

1874



1935

S. W. CARD MFG. CO.

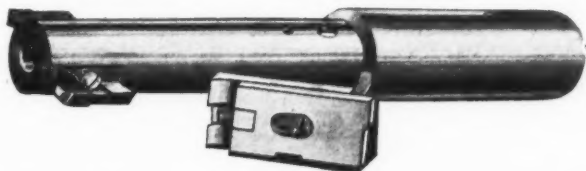
Division of Union Twist Drill Co.

MANSFIELD

MASS., U. S. A.

MADISON BORING BARS

You can bore to close limits—and faster—with Madison Boring Bars because they cannot overheat. Distortion is entirely eliminated, and floating cutters compensate for any misalignments. Their operation costs less than reaming, and they work in cast-iron, bronze and steel. Adjustable to .00025, Madison Boring Bars handle all boring work from $\frac{1}{8}$ " up. Circulars on request.



Madison Manufacturing Co.,

Muskegon, Mich.

NEW MOLD AND DIE CUTTING METHODS

Ask for 40-page catalog on the new Deckel Machines for producing bakelite molds, die casting and embossing dies, etc., direct from a sample of work.

Preis Engraving Machine Co.

157 SUMMIT ST., NEWARK, N. J.

Famous for quality of threads they produce, long life of chasers and all-around dependability.

Following literature available:

Bulletin on H & G General Purpose Die Heads,
Bulletin on new Insert Chaser Type of Die Head,
Bulletin on H & G Threading Machines.

The Eastern Machine Screw Corp.

23-43 Barclay Street, New Haven, Conn.
Los Angeles: A. C. Behringer, 312-316 Commercial St., Los Angeles, Cal.
San Francisco: A. H. Coates Company, 1142 Howard St., San Francisco, Cal.



Die Heads

Better Methods

Better Die Castings



Since 1919



The Superior Die Casting Co.
CLEVELAND, OHIO

CINCINNATI CHICAGO PITTSBURGH DETROIT NEW YORK



KNURLED UNBRAKO Socket Head Cap Screw

All mechanics use their fingers driving Screws. Knurls gear fingers to head; fingers, therefore, have better purchase, drive faster and further. Pliers bite the Knurled "Unbrako," but slip on Smooth-Heads.

Ask how we lock the Knurled "Unbrako" when countersunk—it's unique.

The Knurled "Unbrako" looks trim and attractive and dolls up any piece of machinery.

U. S. & Foreign
Pat.'s Pending

**ORDER BY NAME—SPECIFY THE
KNURLED "UNBRAKO"**

Free Samples Box 22

STANDARD PRESSED STEEL CO.

Free
Jenkinstown, Pa. Samples

GEARS, RAWHIDE AND NON-METALLIC

Boston Gear Works, Inc., North Quincy, Mass.
Cincinnati Gear Co., Cincinnati, Ohio.
Diefendorf Gear Corp., Syracuse, N. Y.
Earle Gear & Mfg. Co., 4709 Stenton Ave., Philadelphia.
General Electric Co., Schenectady, N. Y.
Grant Gear Works, Inc., Boston, Mass.
Hartford Special Mch. Co., Hartford, Conn.
Massachusetts Gear & Tool Co., 34 Nashua St., Woburn, Mass.
Philadelphia Gear Works, Philadelphia.
Stahl Gear & Machine Co., Cleveland.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GENERATORS, ELECTRIC

Fairbanks-Morse & Co., 9th and Wabash Ave., Chicago.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Preis Engraving Machine Co., 157 Summit St., Newark, N. J.

GREASE

Bun Oil Co., Philadelphia.

GREASE CUPS

Link-Belt Co., Chicago.

GRINDERS, PORTABLE ELECTRIC

Chicago Wheel & Mfg. Co., 114 So. Aberdeen St., Chicago, Ill.
Dumore Company, Racine, Wis.
White, S. S., Dental Mfg. Co., 150 W. 42nd St., New York, N. Y.

GRINDERS, PNEUMATIC

Madison-Kipp Corp., Madison, Wis.

GRINDING MACHINES, ABRASIVE BELT

Porter-Cable Machine Co., Salina and Wolf Streets, Syracuse, N. Y.
Production Mch. Co., Greenfield, Mass.
Walla Sales Corp., 96 Warren St., New York, N. Y.

GRINDING MACHINES, BENCH

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Ct.

Diamond Machine Co., Providence, R. I.

Harding Bros., Inc., 1418 College Ave., Elmira, N. Y.

New Britain Gridley Machine Co., New Britain, Ct.

Ransom Grinding Machine Co., Oshkosh, Wis.

Rivett Lathe & Grinder Inc., Brighton, Boston, Mass.

Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, CAMSHAFT

Landis Tool Co., Waynesboro, Pa.

Norton Co., Worcester, Mass.

GRINDING MACHINES, CENTERLESS

Cincinnati Grinders, Inc., Cincinnati, Ohio.

GRINDING MACHINES, CHASER OR DIE

Eastern Machine Screw Corp., New Haven, Conn.

Geometric Tool Co., New Haven, Conn.

H & G Works, Eastern Machine Screw Corp., New Haven, Conn.

Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, CHUCKING

Bryant Chucking Grinder Co., Springfield, Vt.

GRINDING MACHINES, CONTOUR

Baker Brothers, Inc., Toledo, O.

GRINDING MACHINES, CRANKSHAFT

Cincinnati Grinders, Inc., Cincinnati, Ohio.

Landis Tool Co., Waynesboro, Pa.

Norton Co., Worcester, Mass.

GRINDING MACHINES, CUTTER

See Grinding Machines, Tool & Cutter

GRINDING MACHINES, CYLINDER

Heald Machine Co., Worcester, Mass.

Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, CYLINDRICAL, PLAIN AND UNIVERSAL

Brown & Sharpe Mfg. Co., Providence, R. I.

Cincinnati Grinders, Inc., Cincinnati, Ohio.

Landis Tool Co., Waynesboro, Pa.

Modern Tool Works (Consolidated Mch. Tool Corp.), Rochester, N. Y.

Morse Twist Drill & Machine Co., New Bedford, Mass.

Norton Co., Worcester, Mass.

Pratt & Whitney Co., Hartford, Conn.

GRINDING MACHINES, DIE SINKERS—PORTABLE

Jarvis, Chas. L., Co., Gildersleeve, Conn.
White, S. S., Dental Mfg. Co., 150 W. 42nd St., New York, N. Y.

GRINDING MACHINES, DISC

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Ct.

Diamond Machine Co., Providence, R. I.

Porter-Cable Machine Co., Salina and Wolf Streets, Syracuse, N. Y.

Rowbottom Machine Co., Waterbury, Conn.

GRINDING MACHINES, DRILL

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Ct.

Gallmeyer & Livingston Co., Grand Rapids, Mich.

Morse Twist Drill & Machine Co., New Bedford, Mass.

Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

Star Machine & Engineering Corp., Bloomfield, N. J.

Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, FACE

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Ct.

Diamond Machine Co., Providence, R. I.

GRINDING MACHINES, FLOOR STAND TYPE

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Ct.

Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago.

Diamond Machine Co., Providence, R. I.

Ransom Grinding Machine Co., Oshkosh, Wis.

GRINDING MACHINES, HOB

Barber-Colman Co., Rockford, Ill.

Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, INTERNAL

Bryant Chucking Grinder Co., Springfield, Vt.

Greenfield Tap & Die Corp., Greenfield, Mass.

Heald Machine Co., Worcester, Mass.

Landis Tool Co., Waynesboro, Pa.

Modern Tool Works (Consolidated Mch. Tool Corp.), Rochester, N. Y.

Rivett Lathe & Grinder Inc., Brighton, Boston, Mass.

Van Norman Mch. Tool Co., Springfield, Mass.

GRINDING MACHINES, KNIFE AND SHEAR BLADE

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Ct.

Diamond Machine Co., Providence, R. I.

GRINDING MACHINES, PISTON RING

Heald Machine Co., Worcester, Mass.

GRINDING MACHINES, PORTABLE ELECTRIC AND TOOLPOST

See under Grinders, Portable Electric.

GRINDING MACHINES, PULLEY

Diamond Machine Co., Providence, R. I.

Graham Mfg. Co., Providence, R. I.

GRINDING MACHINES, RADIAL, BALL RACE, ETC.

Landis Tool Co., Waynesboro, Pa.

Van Norman Mch. Tool Co., Springfield, Mass.

GRINDING MACHINES, RADIUS, LINK

Sundstrand Machine Tool Co., Rockford, Ill.

GRINDING MACHINES, RING WHEEL

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Ct.

Diamond Machine Co., Providence, R. I.

Graham Mfg. Co., Providence, R. I.

GRINDING MACHINES, ROLL

Landis Tool Co., Waynesboro, Pa.

Norton Co., Worcester, Mass.

GRINDING MACHINES, SURFACE

Abrasive Machine Tool Co., East Providence, R. I.

Blanchard Machine Co., 64 State St., Cambridge, Mass.

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Ct.

Brown & Sharpe Mfg. Co., Providence, R. I.

Diamond Machine Co., Providence, R. I.

Gallmeyer & Livingston Co., Grand Rapids, Mich.

Heald Machine Co., Worcester, Mass.

Mattison Machine Works, Rockford, Ill.

Norton Co., Worcester, Mass.

Pratt & Whitney Co., Hartford, Conn.

Rowbottom Machine Co., Waterbury, Conn.

Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, SWING FRAME

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.

Diamond Machine Co., Providence, R. I.

GRINDING MACHINES, TAP

Gallmeyer & Livingston Co., Grand Rapids, Mich.

Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDING MACHINES, TOOL AND CUTTER

Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.

Baird Machine Co., Bridgeport, Conn.

Barber-Colman Co., Rockford, Ill.

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.

Brown & Sharpe Mfg. Co., Providence, R. I.

Cincinnati Grinders, Inc., Cincinnati, Ohio.

Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.

Diamond Machine Co., Providence, R. I.

Dumore Company, Racine, Wis.

Fafnir Bearing Co., New Britain, Conn.

Gallmeyer & Livingston Co., Grand Rapids, Mich.

Gisholt Machine Co., Madison, Wis.

Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.

Landis Tool Co., Waynesboro, Pa.

LeBlond, R. K., Machine Tool Co., Cincinnati, O.

Modern Tool Works (Consolidated Mch. Tool Corp.), Rochester, N. Y.

Morse Twist Drill & Machine Co., New Bedford, Mass.

Mummet-Dixon Co., Hanover, Pa.

Norton Co., Worcester, Mass.

Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

Pratt & Whitney Co., Hartford, Conn.

Ransom Grinding Machine Co., Oshkosh, Wis.

Sundstrand Machine Tool Co., Rockford, Ill.

Union Twist Drill Co., Athol, Mass.

Walker, O. S., Co., Inc., Worcester, Mass.

Waltham Mch. Wks., Waltham, Mass.

GRINDING MACHINES, UNIVERSAL LATHE AND PLANNER TOOL

Gisholt Machine Co., Madison, Wis.

GRINDING WHEELS

Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.

Carborundum Co., Niagara Falls, N. Y.

Chicago Wheel & Mfg. Co., 114 So. Aberdeen St., Chicago, Ill.

Norton Co., Worcester, Mass.

GUARDS FOR MACHINERY

New Britain Gridley Machine Co., New Britain, Ct.

Wiesman Mfg. Co., Dayton, O.

GUARDS FOR PUNCH PRESSES, SAFETY

Taylor-Shantz Co., Rochester, N. Y.

Wiesman Mfg. Co., Dayton, O.

HAMMERS, DROP

Morgan Engineering Co., Alliance, O.

HAMMERS, SOFT

Greene, Tweed & Co., 109 Duane St., New York City.

HAMMERS, STEAM

Morgan Engineering Co., Alliance, O.

HANGERS, SHAFT

Boston Gear Works, Inc., North Quincy, Mass.

Brown & Sharpe Mfg. Co., Providence, R. I.

Fafnir Bearing Co., New Britain, Conn.

Hyatt Roller Bearing Co., Newark, N. J.

Link-Belt Co., Chicago.

New Departure Mfg. Co., Bristol, Ct.

Shaffer Bearing Corp., 6519 W. Grand Ave., Chicago.

S. K. F. Industries, Inc., Philadelphia.

Standard Pressed Steel Co., Jenkintown, Pa.

HARDNESS TESTING INSTRUMENTS

Shore Instrument & Mfg. Co., Jamaica, N. Y.

Wilson Mechanical Instrument Co., Inc., 382 Concord Ave., New York.

HEAT TREATMENT OF STEEL

American Metal Treatment Co., Elizabeth, N. J.

Bennett Metal Treating Co., Elmwood, Conn.

Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.

HOBBIING MACHINES

See Gear Cutting Machines, Helical and Spur (Hob) and Gear Cutting Machines, Worms and Worm Wheels (Hob).

HOBS

Barber-Colman Co., Rockford, Ill.

Brown & Sharpe Mfg. Co., Providence, R. I.

Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich.

Greenfield Tap & Die Corp., Greenfield, Mass.

Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.

National Twist Drill & Tool Co., Detroit, Mich.

Union Twist Drill Co., Athol, Mass.

HOIST HOOKS

Williams, J. H., & Co., 75 Spring St., New York, N. Y.

HOISTING AND CONVEYING MACHINERY

Link-Belt Co., Chicago.

Shepard Niles Crane & Hoist Corp., 444 Schuyler Ave., Montclair, N. Y.

HOISTS, CHAIN, ETC.

Ford Chain Block Co., Philadelphia.

Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

HOISTS, ELECTRIC

Philadelphia Gear Works, Philadelphia.

Shepard Niles Crane & Hoist Corp., 444 Schuyler Ave., Montclair, N. Y.

HONING MACHINES, CYLINDER

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

Moline Tool Co., Moline, Ill.

HYDRAULIC MACHINERY AND TOOLS

Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago.

Morgan Engineering Co., Alliance, O.

Oilgear Co., Milwaukee, Wis.

INDEX CENTERS

Abrasive Machine Tool Co., East Providence, R. I.

Brown & Sharpe Mfg. Co., Providence, R. I.

INDICATORS, DIAL

Starrett, L. S., Co., Athol, Mass.

INDICATORS, SPEED

Bristol Co., Waterbury, Conn.

Brown & Sharpe Mfg. Co., Providence, R. I.

Greene, Tweed & Co., 109 Duane St., New York City.

Starrett, L. S., Co., Athol, Mass.

INDICATORS, TEST

Brown & Sharpe Mfg. Co., Providence, R. I.

Federal Products Corp., Providence, R. I.

Norton Co., Worcester, Mass.

Starrett, L. S., Co., Athol, Mass.

INTENSIFIERS, HYDRAULIC

Morgan Engineering Co., Alliance, O.

JACKS, PLANNER

Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.

JIGS AND FIXTURES

Automatic Machine Co., Bridgeport, Ct.

Brown & Sharpe Mfg. Co., Providence, R. I.

Columbus Die, Tool & Machine Co., Columbus, O.

Gisholt Machine Co., Madison, Wis.

Hartford Special Mch. Co., Hartford, Conn.



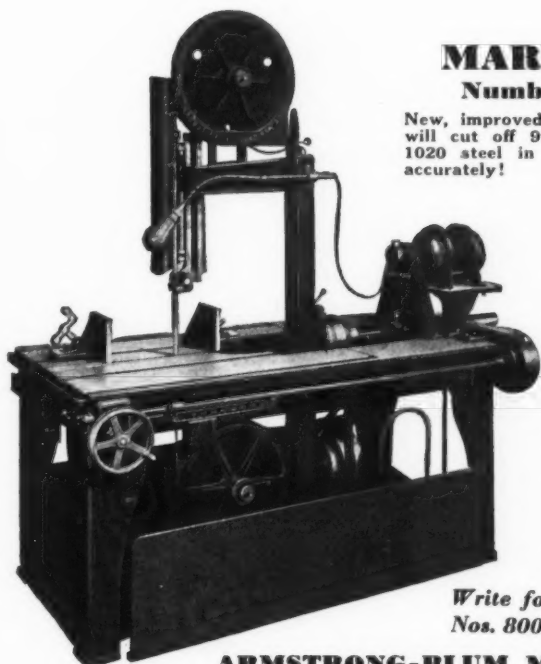
first . . . a **MARVEL** Number 8 Band Saw

. . . for universal work

WHEN you face the problem of selecting the first saw for each individual shop or department, be sure you equip with the only machine that will "handle every sawing job under the sun that may arise in that shop."—The *universal* No. 8 MARVEL Metal Band Saw will handle *any job* . . . the lightest, most delicate work, as well as extremely large and heavy work to 18" X 18"; will cut accurately, straight and square; will cut at any angle, to 45 degrees to right or left; will do notching, blocking, coping and roughing-out work. With a No. 8 MARVEL, no job will "stump" you.

As builders of a most complete line of saws we unhesitatingly recommend "a No. 8 MARVEL Band Saw first."

Later, when that shop gets into highly specialized quantity production, you will need a MARVEL Fully Automatic Production Saw that will cut off bar steel into short lengths for gear blanks, steel parts, forgings, etc., automatically at speeds as high as 6 square inches per minute, floor to floor. Your first saw, then, should be a MARVEL No. 8 Universal Band Saw.

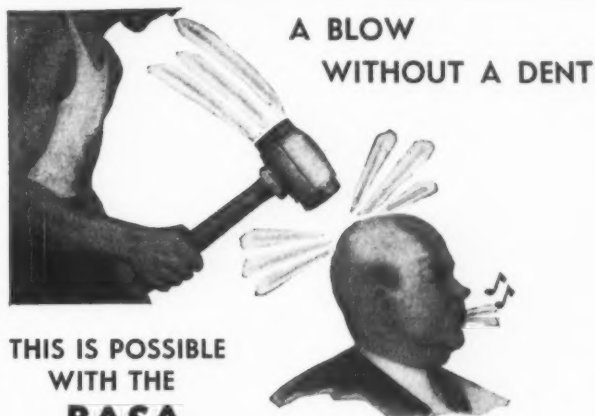


MARVEL Number 8

New, improved 1935 model will cut off 9" round No. 1020 steel in 20 minutes, accurately!

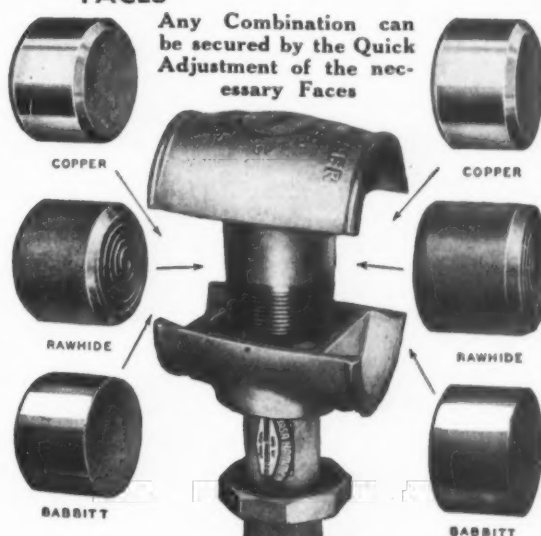
Write for Bulletins
Nos. 800A and 600

ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
343 N. Francisco Ave., CHICAGO, U.S.A.



THIS IS POSSIBLE
WITH THE
**BASA
HAMMER**
WITH REMOVABLE
FACES

MADE IN FIVE
DIFFERENT SIZES



Any Combination can
be secured by the Quick
Adjustment of the nec-
essary Faces

The "BASA"
meets the demand
for a hammer
that will provide
a striking surface
required by vari-
ous types of work.

In finishing and
assembling work
it is often desir-
able to use a
hammer that can
strike more than
one kind of blow.



USE OUR
EMPIRE
RAWHIDE
MALLETS

WHEN
MALLETS
OF SUPERIOR
QUALITY
ARE WANTED

The Rawhide, Copper and
Babbitt Faces make it
possible to adapt this
hammer to any class of
work.

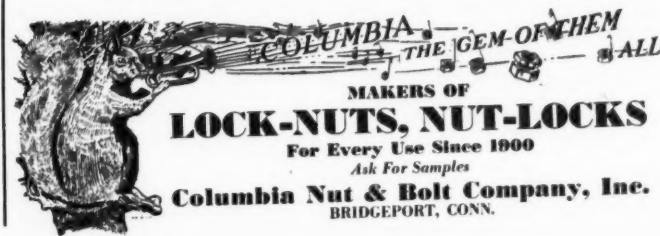
Write for full particulars on
the "Basa" and "Empire."

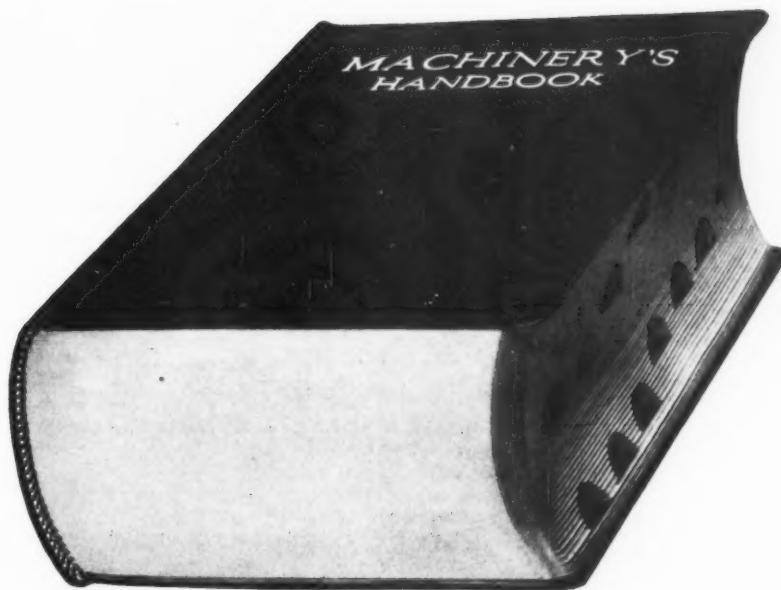
**GREENE, TWEED
& CO.**

Sole Manufacturers
109 Duane St., New York

London Representatives:
W. F. Johnson & Co., (London)
Ltd., 14 & 16 Farringdon
Road, London, E.C.1.

- Lodge & Shipley Machine Tool Co.**, Cincinnati, O.
McCroskey Tool Corp., Meadville, Pa.
Moline Tool Co., Moline, Ill.
Rivett Lathe & Grinder Inc., Brighton, Boston, Mass.
Seneca Falls Machine Co., Seneca Falls, New York.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
Sundstrand Mch. Tool Co., Rockford, Ill.
- LATHES DOGS**
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Ready Tool Co., Bridgeport, Conn.
Williams, J. H. & Co., 75 Spring St., New York City.
- LATHES, AUTOMATIC**
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
New Britain Gridley Machine Co., New Britain, Ct.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Rockford Machine Tool Co., 2412 Kishwaukee Road, Rockford, Ill.
Sundstrand Machine Tool Co., Rockford, Ill.
- LATHES, AXLES AND SHAFT**
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Seneca Falls Machine Co., Seneca Falls, New York.
Sundstrand Machine Tool Co., Rockford, Ill.
- LATHES, BENCH**
Ames, B. C. Co., Waltham, Mass.
Hardinge Bros. Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder Inc., Brighton, Boston, Mass.
Seneca Falls Machine Co., Seneca Falls, New York.
South Bend Lathe Works, Inc., South Bend, Ind.
Van Norman Mch. Tool Co., Springfield, Mass.
- LATHES, BORING**
Gisholt Machine Co., Madison, Wis.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
- LATHES, BRASS WORKERS'**
Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago.
Seneca Falls Machine Co., Seneca Falls, New York.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
- LATHES, CRANKSHAFT**
Crankschaft Machine Co., Jackson, Mich.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
Sundstrand Machine Tool Co., Rockford, Ill.
- LATHES, DOUBLE-END**
Greenlee Bros. & Co., Rockford, Ill.
Sundstrand Mch. Tool Co., Rockford, Ill.
- LATHES, ENGINE**
Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros. Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
Porter-Cable Machine Co., Salina and Wolf Streets, Syracuse, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Seneca Falls Machine Co., Seneca Falls, New York.
South Bend Lathe Works, Inc., South Bend, Ind.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
- LATHES, EXTENSION BED AND GAP**
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
South Bend Lathe Works, Inc., South Bend, Ind.
- LATHES, GUN BORING**
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
- LATHES, SPINNING**
 See Chucking Machines.
- LATHES, TURRET**
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Greenlee Bros. & Co., Rockford, Ill.
Hardinge Bros. Inc., 1418 College Ave., Elmira, N. Y.
Jones & Lamson Machine Co., Springfield, Vt.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
New Britain Gridley Machine Co., New Britain, Ct.
- Pratt & Whitney Co.**, Hartford, Conn.
Rivett Lathe & Grinder Inc., Brighton, Boston, Mass.
South Bend Lathe Works, Inc., South Bend, Ind.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
- LAVA PRODUCTS, EXTRUDED AND MOLDED**
American Lava Corp., Chattanooga, Tenn.
- LEVELS**
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S. Co., Athol, Mass.
Universal Boring Machine Co., Hudson, Mass.
- LOCK, NUTS**
Columbia Nut & Bolt Co., Inc., Bridgeport, Ct.
- LUBRICANTS**
Pyrrol Co., LaCrosse, Wis.
Sun Oil Co., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
- LUBRICATING SYSTEMS**
Greene, Tweed & Co., 109 Duane St., New York City.
Madison-Kipp Corp., Madison, Wis.
Rivett Lathe & Grinder Inc., Brighton, Boston, Mass.
- LUBRICATORS FOR AIR LINES**
Norgren, C. A. Co., Inc., Denver, Colo.
- MACHINISTS' SMALL TOOLS**
 See Calipers, Hammers, Wrenches, Drills, Taps, etc.
- MANDRELS, EXPANDING AND SOLID**
 See Arbors and Mandrels, Expanding and Solid.
- MARKING MACHINES**
V. & O. Press Co., Hudson, N. Y.
- MEASURING MACHINES, PRECISION**
Federal Products Corp., Providence, R. I.
Hanson-Whitney Mch. Co., Hartford, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Pratt & Whitney Co., Hartford, Conn.
- METALS, BEARING**
 See Bearing Bronze, Babbitt, etc., and Bushings, Brass, Bronze, etc.
- METERS (See Recording Instruments)**
- MICROMETERS**
Bath, John & Co., Inc., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S. Co., Athol, Mass.
- MILLING AND DRILLING MACHINES, UPRIGHT**
 See Drilling and Milling Machines, Vertical.
- MILLING ATTACHMENTS**
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
Porter-Cable Machine Co., Salina and Wolf Streets, Syracuse, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.
- MILLING MACHINES, AUTOMATIC**
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
Porter-Cable Machine Co., Salina and Wolf Streets, Syracuse, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Sundstrand Machine Tool Co., Rockford, Ill.
- MILLING MACHINES, CIRCULAR CONTINUOUS**
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Sundstrand Machine Tool Co., Rockford, Ill.
- MILLING MACHINES, DUPLEX**
Brown & Sharpe Mfg. Co., Providence, R. I.
Van Norman Mch. Tool Co., Springfield, Mass.
- MILLING MACHINES, HAND**
Pratt & Whitney Co., Hartford, Conn.
Sundstrand Mch. Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.
- MILLING MACHINES, HORIZONTAL, PLAIN AND UNIVERSAL**
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
LeBlond, R. K., Machine Tool Co., Cincinnati, O.
McCroskey Tool Corp., Meadville, Pa.
Rowbottom Machine Co., Waterbury, Conn.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Sundstrand Mch. Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.
- MILLING MACHINES, LINCOLN TYPE**
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Sundstrand Machine Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.
- MILLING MACHINES, MULTIPLE SPINDLE**
Automatic Machine Co., Bridgeport, Ct.
Hall Planetary Co., Philadelphia, Pa.
- MILLING MACHINES, PLANETARY**
Hall Planetary Co., Philadelphia, Pa.
- MILLING MACHINES, UNIVERSAL**
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Gorton, Geo. Mch. Co., 1109 13th St., Racine, Wis.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Sundstrand Mch. Tool Co., Rockford, Ill.
- MILLING MACHINES, VERTICAL**
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Gorton, Geo. Mch. Co., 1109 13th St., Racine, Wis.
Preis Engraving Machine Co., 157 Summit St., Newark, N. J.
Sundstrand Machine Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.
- MILLING TOOLS, HOLLOW ADJUSTABLE**
Geometric Tool Co., New Haven, Conn.
- MODEL AND EXPERIMENTAL WORK**
 See Special Machinery and Tools.
- MOTORS, ELECTRIC**
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dumore Company, Racine, Wis.
Fairbanks-Morse & Co., 9th and Wabash Ave., Chicago.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland, Ohio.
Star Machine & Engineering Corp., Bloomfield, N. J.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
- NIBBLING MACHINES**
Schatz Mfg. Co., Poughkeepsie, N. Y.
- NICKEL**
International Nickel Co., 67 Wall St., New York.
- NIPPLE THREADING MACHINERY**
Landis Mch. Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
Murphy Mch. & Tool Co., 951 Porter St., Detroit.
- NUT SETTING EQUIPMENT**
 See Screw Driving and Nut Setting Equipment.
- NUT TAPPERS**
 See Bolt and Nut Machinery.
- OIL CUPS**
Boston Gear Works, Inc., North Quincy, Mass.
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago.
- OIL GROOVERS**
Hanson-Whitney Mch. Co., Hartford, Conn.
- OIL HOLE COVERS**
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago.
- OILERS**
Madison-Kipp Corp., Madison, Wis.
- OILS, LUBRICATING**
Pyrrol Co., LaCrosse, Wis.
Sun Oil Co., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
- OILS, QUENCHING AND TEMPERING**
Sun Oil Co., Philadelphia, Pa.
- OILS, SOLUBLE**
 See Compounds, Cutting, Grinding, etc.
- OXYGEN**
Linde Air Products Co., 30 E. 42nd St., New York.
- PACKING, LEATHER, METAL, RUBBER, ETC.**
Garlock Packing Co., Palmyra, N. Y.
- PARALLELS**
Starrett, L. S. Co., Athol, Mass.
Walker, O. S. Co., Inc., Worcester, Mass.
- PATTERN SHOP MACHINERY**
Porter-Cable Machine Co., Salina and Wolf Streets, Syracuse, N. Y.
- PATTERNS, METAL**
Mummet-Dixon Co., Hanover, Pa.
V & O Press Co., Hudson, N. Y.
- PATTERNS, WOOD**
V & O Press Co., Hudson, N. Y.
- PHOSPHOR BRONZE**
 See Bronze.
- PILLOW BLOCKS**
Shafer Bearing Corp., 6519 W. Grand Ave., Chicago.
- PIPE, BRASS AND COPPER**
Revere Copper and Brass Inc., 230 Park Ave., New York, N. Y.
- PIPE CUTTING AND THREADING MACHINES**
Foot-Burt Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
Murphy Mch. & Tool Co., 951 Porter St., Detroit.
- PIPE, STEEL**
National Tube Co., Pittsburgh, Pa.
- PIPE TONGS**
Williams, J. H. & Co., 75 Spring St., New York, N. Y.
- PLANNER ATTACHMENTS**
Hanson-Whitney Mch. Co., Hartford, Conn.
- PLANERS**
Automatic Machine Co., Bridgeport, Ct.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Rockford Machine Tool Co., Rockford, Ill.
- PLATE ROLLS**
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Schatz Mfg. Co., Poughkeepsie, N. Y.
- PLATES, SURFACE**
Brown & Sharpe Mfg. Co., Providence, R. I.
- PULLEYS, FRICTION**
Conway Clutch Co., Cincinnati, Ohio.
- PNEUMATIC EQUIPMENT**
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
- POLISHING LATHES AND MACHINES**
Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn.
Diamond Machine Co., Providence, R. I.
New Britain Gridley Machine Co., New Britain, Ct.
Production Mch. Co., Greenfield, Mass.
- PRESSES, ARBOR**
Barnes, W. F. & John Co., Rockford, Ill.
Candy-Otto Mfg. Co., Chicago Heights, Ill.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
- PRESSES, BRACING**
Oilgear Co., Milwaukee, Wis.
V & O Press Co., Hudson, N. Y.
- PRESSES, DROP**
 See Hammers, Drop.
- PRESSES, FOOT**
Baird Machine Co., Bridgeport, Conn.
Niagara Machine & Tool Wks., Buffalo, N. Y.
V & O Press Co., Hudson, N. Y.
- PRESSES, FORGING**
Morgan Engineering Co., Alliance, O.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
V & O Press Co., Hudson, N. Y.
Zeh & Hahnemann Co., Newark, N. J.
- PRESSES, HYDRAULIC**
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
- PRESSES, ORGANIC**
Morgan Engineering Co., Alliance, O.
Oilgear Co., Milwaukee, Wis.
- PRESSES, PERCUSSION**
Zeh & Hahnemann Co., Newark, N. J.
- PRESSES, SCREW**
Barnes, W. F. & John Co., Rockford, Ill.
- Niagara Machine & Tool Wks.**, Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
- PRESSES, SHEET METAL WORKING**
Automatic Machine Co., Bridgeport, Ct.
Baird Machine Co., Bridgeport, Conn.
Loshough-Jordan Tool & Mch. Co., Elkhart, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Swaine, Fred J., Manufacturing Co., St. Louis, Mo.
Taylor-Shantz Co., Rochester, N. Y.
V & O Press Co., Hudson, N. Y.
Zeh & Hahnemann Co., Newark, N. J.
- PRESSES, STRAIGHTENING**
Candy-Otto Mfg. Co., Chicago Heights, Ill.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago.
- Morgan Engineering Co.**, Alliance, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.





MACHINERY'S HANDBOOK

A NEW EDITION

The 9th Edition is packed full of the latest standards and engineering data—cold facts used daily by designers and builders of everything mechanical.

Any handbook after a few years is bound to contain data unsafe to use because of changes in mechanical standards and progress in engineering and manufacturing practice. An up-to-date handbook is essential. Secure this 9th Edition of MACHINERY'S Handbook—the latest and best—and the most helpful book in existence for designing department or shop.

If you are one of the 227,000 owners of older editions of MACHINERY'S Handbook, check your old book. If it is earlier than the 8th Edition of 1930 (see main title page), note that 367 additions and revisions, large and small, have been made since 1930, not to mention numerous changes prior to this date. The latest or 9th Edition alone contains 175 additions or revisions ranging from complete new sections to small but very important changes for all engineers, machine shop executives, and mechanics.

MACHINERY'S HANDBOOK ORDER FORM

NEW EDITION NOW READY FOR IMMEDIATE DELIVERY

THE INDUSTRIAL PRESS, 148 Lafayette St., New York.

Send me a copy of the 9th Edition of MACHINERY'S Handbook. I enclose \$5.70, payment in full (\$6 less 5% cash discount). Or I enclose \$2—initial payment—the remainder payable at the rate of \$2 a month for two months.

NAME

HOME ADDRESS

CITY AND STATE

FIRM

POSITION

☐

Check here to accept special combination offer of MACHINERY'S Handbook and a subscription to MACHINERY for one year. \$7.50 cash with order, or \$3 with order and \$2.50 monthly for two months.

M-8/35

PRICE

\$5.70

Cash with order

\$6.00

In three payments

See terms on order
form

PROFILING MACHINES

Automatic Machine Co., Bridgeport, Ct.
Gorton, Geo. Mch. Co., 1109 13th
St., Racine, Wis.
Leland-Gifford Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.

PULLEYS

Boston Gear Works, Inc., North Quincy,
Mass.
Link-Belt Co., Chicago.

PULLEYS, FRICTION

Link-Belt Co., Chicago.

PULLEY, V-BELT

Allis-Chalmers Mfg. Co., Milwaukee,
Wis.

PUMP LEATHERS

Roper, Geo. D., Corp., Rockford, Ill.

PUMPS, COOLANT, LUBRICANT**AND OIL**

Brown & Sharpe Mfg. Co., Providence.
Roper, Geo. D., Corp., Rockford, Ill.
Ruthman Machinery Co., 534-536 E.
Front St., Cincinnati, O.

PUMPS, HYDRAULIC

Oilgear Co., Milwaukee, Wis.
Roper, Geo. D., Corp., Rockford, Ill.

PUMPS, PNEUMATIC

Roper, Geo. D., Corp., Rockford, Ill.

PUMPS, ROTARY

Leiman Bros., Inc., Newark, N. J.

Roper, Geo. D., Corp., Rockford, Ill.

PUMPS, VACUUM

Allis-Chalmers Mfg. Co., Milwaukee,
Wis.

Leiman Bros., Inc., Newark, N. J.

PUNCHING MACHINERY

Armstrong-Blum Mfg. Co., 343 N. Fran-
cisco Ave., Chicago.

Consolidated Mch. Tool Corp. of Amer-
ica, Rochester, N. Y.

Loebhough-Jordan Tool & Mch. Co.,
Elkhart, Ind.

Niagara Machine & Tool Works,
Buffalo.

Ryerson, Joseph T. & Son, Inc., 2558
W. 16th St., Chicago, Ill.

PYROMETERS

American Gas Furnace Co., Elizabeth,
N. J.

Bristol Co., Waterbury, Conn.

Leeds & Northrup Co., Philadelphia.

Russell Electric Co., 354 Huron St.,
Chicago.

Shore Instrument & Mfg. Co., Jamaica,
N. Y.

RACKS, GEAR, CUT

Boston Gear Works, Inc., North Quincy,
Mass.

Fellows Gear Shaper Co., Springfield, Vt.

Hartford Special Mch. Co., Hartford,
Conn.

Massachusetts Gear & Tool Co., 34
Nashua St., Woburn, Mass.

Philadelphia Gear Works, Philadelphia.

Stahl Gear & Machine Co., Cleveland.

RADIATORS, JAPANNING-OVEN

American Gas Furnace Co., Elizabeth,
N. J.

REAMER HOLDERS

Landis Mch. Co., Inc., Waynesboro, Pa.

McCrosky Tool Corp., Meadville, Pa.

REAMERS

Barber-Colman Co., Rockford, Ill.

Brown & Sharpe Mfg. Co., Providence.

Butterfield Div., Union Twist Drill Co.,
Derby Line, Vt.

Carboloy Co., Inc., Detroit, Mich.

Card, S. W., Mfg. Co., Mansfield, Mass.

Cleveland Twist Drill Co., Cleveland, O.

Columbus Die, Tool & Machine Co.,
Columbus, O.

Davis Boring Tool Co., Inc., 6200
Maple Ave., St. Louis, Mo.

Ex-Cell-O Aircraft & Tool Corp., De-
troit, Mich.

Greenfield Tap & Die Corp., Green-
field, Mass.

Haynes Stellite Co., Kokomo, Ind.

Illinois Tool Works, 2501 North Keeler
Ave., Chicago, Ill.

McCrosky Tool Corp., Meadville, Pa.

Morse Twist Drill & Machine Co., New
Bedford, Mass.

National Twist Drill & Tool Co., De-
troit, Mich.

Pratt & Whitney Co., Hartford, Conn.

Standard Tool Co., Cleveland, O.

Union Twist Drill Co., Athol, Mass.

REAMERS, ADJUSTABLE

Barber-Colman Co., Rockford, Ill.

Cleveland Twist Drill Co., Cleveland, O.

Davis Boring Tool Co., Inc., 6200
Maple Ave., St. Louis, Mo.

Gisholt Machine Co., Madison, Wis.

Greenfield Tap & Die Corp., Green-
field, Mass.

Hannifin Mfg. Co., 621 S. Kolmar Ave.,
Chicago.

McCrosky Tool Corp., Meadville, Pa.

Morse Twist Drill & Machine Co., New
Bedford, Mass.

Pratt & Whitney Co., Hartford, Conn.

Union Twist Drill Co., Athol, Mass.

REAMERS, TAPER PIN HOLE

Greenfield Tap & Die Corp., Green-
field, Mass.

Pratt & Whitney Co., Hartford, Conn.

Union Twist Drill Co., Athol, Mass.

REAMING MACHINES

Blanchard Machine Co., 64 State St.,
Cambridge, Mass.

RECORDING INSTRUMENTS FOR**ELECTRICITY**

Bristol Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philadelphia.

RECORDING INSTRUMENTS FOR**PRESSURE**

Bristol Co., Waterbury, Conn.
Leeds & Northrup Co., Philadelphia.

RECORDING INSTRUMENTS FOR**SPEED**

Bristol Co., Waterbury, Conn.
Leeds & Northrup Co., Philadelphia.

RECORDING INSTRUMENTS FOR**TEMPERATURE**

Bristol Co., Waterbury, Conn.
Leeds & Northrup Co., Philadelphia.

RECORDING INSTRUMENTS FOR**TIME**

Bristol Co., Waterbury, Conn.
Gisholt Machine Co., Madison, Wis.

REGULATORS, TEMPERATURE

American Gas Furnace Co., Elizabeth,
N. J.

Bristol Co., Waterbury, Conn.

Leeds & Northrup Co., Philadelphia.

REMOVERS, JAPAN, ENAMEL, ETC.

Oakite Products, Inc., 26 Thames St.,
New York City.

RHEOSTATS

General Electric Co., Schenectady, N. Y.

RIVETERS, HYDRAULIC

Morgan Engineering Co., Alliance, O.

RIVETERS, PNEUMATIC

Grant Mfg. & Mch. Co., N. W. Sta-
tion, Bridgeport, Conn.

Hannifin Mfg. Co., 621 S. Kolmar Ave.,
Chicago.

RIVETING MACHINES

Grant Mfg. & Mch. Co., N. W. Sta-
tion, Bridgeport, Conn.

ROPE DRIVES

Link-Belt Co., Chicago.

RULES, STEEL

Brown & Sharpe Mfg. Co., Providence.

Starrett, L. S., Co., Athol, Mass.

RUST PREVENTIVE

Oakite Products, Inc., 26 Thames St.,
New York City.

SAFETY GUARDS FOR PUNCH**PRESSES**

Taylor-Shantz Co., Rochester, N. Y.

Wissman Mfg. Co., Dayton, O.

SAND BLAST EQUIPMENT

Leiman Bros., Inc., Newark, N. J.

SANDERS

Porter-Cable Machine Co., Salina and
Wolf Streets, Syracuse, N. Y.

Walls Sales Corp., 96 Warren St.,
New York.

SAW BLADES, HACK

Armstrong-Blum Mfg. Co., 343 N.
Francisco Ave., Chicago.

Starrett, L. S., Co., Athol, Mass.

SAW TABLES

Baker Brothers, Inc., Toledo, O.

SAWING MACHINES, CIRCULAR

Armstrong-Blum Mfg. Co., 343 N.
Francisco Ave., Chicago.

SAWING MACHINES, FRICTION

Bryant Machinery & Engineering Co.,
400 W. Madison St., Chicago.

Ryerson, Joseph T. & Son, Inc., 2558
W. 16th St., Chicago, Ill.

SAWING MACHINES, METAL**CUTTING BAND**

Armstrong-Blum Mfg. Co., 343 N.
Francisco Ave., Chicago.

SAWING MACHINES, POWER HACK

Armstrong-Blum Mfg. Co., 343 N.
Francisco Ave., Chicago.

SAWING MACHINES, WOOD

Barnes, W. F., & John Co., Rockford,
Ill.

SAWS, CIRCULAR METAL CUTTING

Union Twist Drill Co., Athol, Mass.

SAWS, HOLE

Armstrong-Blum Mfg. Co., 343 N.
Francisco Ave., Chicago.

SAWS, SCREW SLOTTING

Barber-Colman Co., Rockford, Ill.

Starrett, L. S., Co., Athol, Mass.

Union Twist Drill Co., Athol, Mass.

SCALES, WEIGHING

Fairbanks-Morse & Co., 9th and Wa-
bash Ave., Chicago.

SCREW CUTTING TOOLS

See Taps and Dies.

SCREW DRIVING AND NUT SET-**TING EQUIPMENT**

Errington Mechanical Laboratory, 200
Broadway, N. Y.

Haakins, R. G., Co., 4634 Fulton St.,
Chicago.

Jarvis, Chas. L., Co., Gildersleeve, Ct.

SCREW MACHINES, AUTOMATIC**SINGLE AND MULTIPLE SPINDLE**

Brown & Sharpe Mfg. Co., Providence.

Cone Auto. Mch. Co., Inc., Windsor, Vt.

Greenlee Bros. & Co., Rockford, Ill.

New Britain Gridley Machine Co., New
Britain, Ct.

SCREW MACHINES, HAND

See also Lathes, Turret.

Brown & Sharpe Mfg. Co., Providence.

Hardinge Bros., Inc., 1418 College Ave.,
Elmira, N. Y.

Jones & Lamson Machine Co., Spring-
field, Vt.

Potter & Johnston Machine Co., Paw-
tucket, R. I.

Pratt & Whitney Co., Hartford, Conn.

Rivett Lathe & Grinder Inc., Brighton,
Boston, Mass.

SCREW MACHINE TOOLS AND**EQUIPMENT**

Brown & Sharpe Mfg. Co., Providence.

Greenlee Bros. & Co., Rockford, Ill.

Jones & Lamson Machine Co., Spring-
field, Vt.

Landis Mch. Co., Inc., Waynesboro, Pa.

Murphy Mch. & Tool Co., 951 Porter
St., Detroit.

New Britain Gridley Machine Co., New
Britain, Ct.

Potter & Johnston Mch. Co., Paw-
tucket, R. I.

Pratt & Whitney Co., Hartford, Conn.

SCREW MACHINE WORK

Eastern Mch. Screw Corp., New Haven,
Conn.

Link-Belt Co., Chicago.

New Britain Gridley Machine Co., New
Britain, Ct.

Standard Pressed Steel Co., Jenkin-
town, Pa.

SCREW PLATES

Butterfield Div., Union Twist Drill Co.,
Derby Line, Vt.

Card, S. W., Mfg. Co., Mansfield, Mass.

Greenfield Tap & Die Corp., Green-
field, Mass.

Morse Twist Drill & Machine Co.,
New Bedford, Mass.

Pratt & Whitney Co., Hartford, Conn.

SCREWS, CAP, SET, SAFETY SET**AND MACHINERY**

Allen Mfg. Co., 125 Shelton St.,
Hartford, Conn.

Bristol Co., Waterbury, Conn.

Holo-Krome Screw Corp., Bristol, Conn.

Standard Pressed Steel Co., Jenkin-
town, Pa.

SCREWS, SELF-TAPPING DRIVE

Parker-Kalon Corp., 200 Varick St.,
New York.

SEALS AND RETAINERS, OIL OR**GREASE**

Garlock Packing Co., Palmyra, N. Y.

SEAMLESS STEEL TUBING

See Tubing, Seamless Steel.

SECOND-HAND MACHINERY, ETC.

Cincinnati Machinery & Supply Co.,
Cincinnati.

Eastern Machinery Co., Cincinnati.

Emerman, Louis E., & Co., 1761 Elston
Ave., Chicago, Ill.

Miles Machinery Co., Saginaw, Mich.

Ryerson, Joseph T. & Son, Inc., 2558
W. 16th St., Chicago, Ill.

SHAFTING, STEEL

Cumberland Steel Company, Cumber-
land, Md.

Ryerson, Joseph T. & Son, Inc., 2558
W. 16th St., Chicago, Ill.

Standard Pressed Steel Co., Jenkin-
town, Pa.

Union Twist Drill Co., Athol, Mass.

SHAFTING, STEEL TUBING FOR

National Tube Co., Pittsburgh, Pa.

SHAFTS, TURNED AND GROUND

Cumberland Steel Company, Cumber-
land, Md.

SHAPERS

Automatic Machine Co., Bridgeport, Ct.

Bryant Machinery & Engineering Co.,
400 W. Madison St., Chicago.

Potter & Johnston Machine Co., Paw-
tucket, R. I.

Rockford Machine Tool Co., 2412
Kishwaukee Road, Rockford, Ill.

Ryerson, Joseph T. & Son, Inc., 2558
W. 16th St., Chicago, Ill.

Springfield Mch. Tool Co., 631 South-
ern Ave., Springfield, O.

SHAPERS, VERTICAL

Hanson-Whitney Mch. Co., Hartford,
Conn.

Pratt & Whitney Co., Hartford, Conn.

SHAPES, STRUCTURAL

Carnegie Steel Co., Pittsburgh, Pa.

SHEARING MACHINERY

Armstrong-Blum Mfg. Co., 343 N.
Francisco Ave., Chicago.

Consolidated Mch. Tool Corp. of Amer-
ica, Rochester, N. Y.

Morgan Engineering Co., Alliance, O.

Niagara Mch. & Tool Wks., Buffalo.

Ryerson, Joseph T. & Son, Inc., 2558
W. 16th St., Chicago, Ill.

Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEARS, ROTARY

Niagara Mch. & Tool Wks., Buffalo.

Ryerson, Joseph T. & Son, Inc., 2558
W. 16th St., Chicago, Ill.

Schatz Mfg. Co., Poughkeepsie, N. Y.

MANUAL OF GEAR DESIGN

NEW BOOKS BY EARLE BUCKINGHAM



Actual Size
8 1/2 by 11 Inches

This is a manual for everyone either designing or producing cut gears. It gives in condensed form various gear-tooth standards, designing formulas, and tables of working data for eliminating tedious time-consuming calculations. These books are approved by the American Gear Manufacturers' Association.

CONTENTS

Section 1—Mathematical Tables—183 Pages

Trigonometrical Functions; Converting Degrees into Radians; Involute Functions; Conversion Table; Gear Ratios and Decimal Equivalents; Factors of Numbers.

Section 2—Spur and Internal Gears—168 Pages

Terms and Definitions; Plane Trigonometry; Involute

Trigonometry; Spur Gears—14 1/2-Degree Composite System; 14 1/2-Degree Full-Depth Involute System; 20-Degree Full-Depth Involute System; 20-Degree Stub Involute System; Internal Gear Drives; Differential Gears; Planetary Gears; Internal Gear Type Clutches; Backlash; Gear Tooth Leads; Non-Metallic Gears; Clock and Instrument Gears.

Formulas are accompanied by practical examples worked out in detail to show the solutions or just how each formula is actually applied in gear-designing practice.

ORDER FORM

THE INDUSTRIAL PRESS, 148 Lafayette St., New York. Send me the books, or book, checked below:

- ☐ Send Sections 1 and 2, Manual of Gear Design. I enclose \$4.50 cash with order. Or, I will pay \$4.75 in three payments—\$1.75 enclosed and the remainder \$1.50 a month for two months.
- ☐ Send Section 1 only. I enclose \$2.50
- ☐ Send Section 2 only. I enclose \$2.50

Name.....

Home Address

City and State

Firm.....

Position.....

M 8/35

MACHINERY, August, 1935—109

SPRINGS

Wickwire Spencer Steel Co., 41 E. 42nd St. New York.

SPROCKET CHAINS

Baldwin-Duckworth Chain Corp., Worcester and Springfield, Mass.
Boston Gear Works, Inc., North Quincy, Mass.
Cullman Wheel Co., 1339 Altgeld St., Chicago.
Grant Gear Works, Inc., Boston, Mass.
Link-Belt Co., Chicago.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.

SPROCKETS

Baldwin-Duckworth Chain Corp., Worcester and Springfield, Mass.
Boston Gear Works, Inc., North Quincy, Mass.
Cullman Wheel Co., 1339 Altgeld St., Chicago.
Grant Gear Works, Inc., Boston, Mass.
Hartford Special Mch. Co., Hartford, Conn.
Link-Belt Co., Chicago.
Massachusetts Gear & Tool Co., 34 Nashua St., Woburn, Mass.
Morse Chain Co., Ithaca, N. Y.
Philadelphia Gear Works, Philadelphia.

STAMPINGS, SHEET METAL

New Britain Gridley Machine Co., New Britain, Ct.
Revere Copper and Brass Inc., 230 Park Ave., New York, N. Y.

STEEL

Carnegie Steel Co., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Illinois Steel Co., 208 S. La Salle St., Chicago, Illinois.
Ludlum Steel Co., Watervliet, N. Y.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Timken Roller Bearing Co., Canton, O.
Wickwire Spencer Steel Co., 41 E. 42nd St., New York.

STEEL ALLOYS

See Alloys. Steel Tungsten, etc.

STEEL, COLD DRAWN

Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Union Drawn Steel Co., Massillon, O.
Wickwire Spencer Steel Co., 41 E. 42nd St., New York.

STEEL, HIGH SPEED TOOL

Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Carpenter Steel Co., Reading, Pa.
Ludlum Steel Co., Watervliet, N. Y.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

STEEL, MACHINE

Carpenter Steel Co., Reading, Pa.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Timken Roller Bearing Co., Canton, O.
Union Drawn Steel Co., Massillon, O.

STEEL, RUSTLESS

Carpenter Steel Co., Reading, Pa.
Ludlum Steel Co., Watervliet, N. Y.
Wickwire Spencer Steel Co., 41 E. 42nd St., New York.

STEEL, STAINLESS

Carpenter Steel Co., Reading, Pa.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Wickwire Spencer Steel Co., 41 E. 42nd St., New York.

STEEL, STRIP AND SHEET

Roebbing's, John A. & Sons Co., Trenton, N. J.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Wickwire Spencer Steel Co., 41 E. 42nd St., New York.

STEEL, ZINC, TIN AND COPPER COATED STRIP

Wickwire Spencer Steel Co., 41 E. 42nd St., New York.

STELLITE

Haynes Stellite Co., Kokomo, Ind.

STOCKS, DIE

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.

STONES, OIL

Carborundum Co., Niagara Falls, N. Y.
Norton-Pike Co., Div. Norton Co., Littleton, N. H.

STRAIGHTENING MACHINERY

Morse Twist Drill & Machine Co., New Bedford, Mass.
Oilgear Co., Milwaukee, Wis.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.

STUD SETTERS

Errington Mechanical Laboratory, 200 Broadway, New York.
Geometric Tool Co., New Haven, Conn.

SUB PRESSES

Danley Machine Specialties, Inc., 2112 South 52nd Ave., Chicago, Ill.
U. S. Tool Co., Inc., Ampere, N. J.

SWAGING MACHINES

Langeller Mfg. Co., Providence, R. I.
Torrington Co., Torrington, Conn.

SWITCHES

Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis.
Bristol Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Shepard Niles Crane & Hoist Corp., 444 Schuyler Ave., Montour Falls, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

TACHOMETERS

Bristol Co., Waterbury, Conn.
Leeds & Northrup Co., Philadelphia.

TAP EXTENSIONS

Allen Mfg. Co., 125 Shelton St., Hartford, Conn.

TAP EXTRACTORS

Walton Co., Hartford, Conn.

TAP HOLDERS

Errington Mechanical Laboratory, 200 Broadway, New York.

TAPPING ATTACHMENTS AND DEVICES

Baker Brothers, Inc., Toledo, O.
Barber-Colman Co., Rockford, Ill.
Buhr Machine Tool Co., Ann Arbor, Mich.
Consolidated Mch. Tool Corp. of America, Rochester, N. Y.
Errington Mechanical Laboratory, 200 Broadway, New York.
Geometric Tool Co., New Haven, Conn.
Haskins, R. G., Co., 4634 Fulton St., Chicago.
Jarvis, Chas. L., Co., Gildersleeve, Ct.
Langeller Mfg. Co., Providence, R. I.
Leland-Gifford Co., Worcester, Mass.
McCrosky Tool Corp., Meadville, Pa.

TAPPING MACHINES

Acme Machinery Co., Cleveland.
Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.
Baker Brothers, Inc., Toledo, O.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, Mich.
Buhr Machine Tool Co., Ann Arbor, Mich.
Geometric Tool Co., New Haven, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Haskins, R. G., Co., 4634 Fulton St., Chicago.
Langeller Mfg. Co., Providence, R. I.
Leland-Gifford Co., Worcester, Mass.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.
Rockford Drilling Mch. Co., Rockford, Ill.

TAPS

Bath, John & Co., Inc., Worcester, Mass.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Ex-Cell-O Aircraft & Tool Corp., Detroit, Mich.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Mch. Co., Hartford, Ct.
Harding Bros. Inc., 1418 College Ave., Elmira, N. Y.
Landis Mch. Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.

TAPS, COLLAPSING

Errington Mechanical Laboratory, 200 Broadway, New York.
Geometric Tool Co., New Haven, Conn.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.

THERMOMETERS

Bristol Co., Waterbury, Conn.

THERMOMETERS, INDICATING AND RECORDING

Bristol Co., Waterbury, Conn.
Leeds & Northrup Co., Philadelphia.

THREAD CUTTING MACHINERY

Acme Machinery Co., Cleveland.
Automatic Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.
Hall Planetary Co., Philadelphia.
H & G Works, Eastern Machine Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.

Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder Inc., Brighton, Boston, Mass.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Eastern Machine Screw Corp., New Haven, Conn.
H & G Works, Eastern Machine Screw Corp., New Haven, Conn.
Ready Tool Co., Bridgeport, Conn.
Rivett Lathe & Grinder Inc., Brighton, Boston, Mass.
Williams, J. H. & Co., 75 Spring St., New York City.

THREAD GAGES

See Gages, Thread.

THREAD MILLING MACHINES

Automatic Machine Co., Bridgeport, Conn.
Hall Planetary Co., Philadelphia.
Hanson-Whitney Mch. Co., Hartford, Ct.
Pratt & Whitney Co., Hartford, Conn.
Waltham Mch. Wks., Waltham, Mass.

THREAD ROLLING MACHINES

V. & O. Press Co., Hudson, N. Y.

TOOL BITS, HIGH SPEED STEEL

Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Barber-Colman Co., Rockford, Ill.
Carpenter Steel Co., Reading, Pa.
Ludlum Steel Co., Watervliet, N. Y.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Williams, J. H. & Co., 75 Spring St., New York City.

TOOL HEADS ADJUSTABLE

Precision Tool Co., Bridgeport, Conn.

TOOL HOLDERS

Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Lovejoy Tool Co., Inc., Springfield, Vt.
Ready Tool Co., Bridgeport, Conn.
Williams, J. H. & Co., 75 Spring St., New York City.

TOOL STEEL

Carpenter Steel Co., Reading, Pa.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

TOOLS, LATHE, SHAPER AND PLANER

Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Carboly Co., Inc., Detroit, Mich.
Gisholt Machine Co., Madison, Wis.
Lovejoy Tool Co., Springfield, Vt.
Ready Tool Co., Bridgeport, Conn.
Williams, J. H. & Co., 75 Spring St., New York City.

TRANSMISSION MACHINERY

See Hangers, Shafting, Pulleys, Clutches, Couplings, Belting, Chains, etc.

TRANSMISSION, VARIABLE SPEED

Link-Belt Co., Chicago.
New Departure Mfg. Co., Bristol, Conn.
Oilgear Co., Milwaukee, Wis.
Reeves Pulley Co., Columbus, Ind.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.

TUBING, BRASS, COPPER AND BRONZE

Revere Copper and Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, STAINLESS STEEL

National Tube Co., Pittsburgh, Pa.

TUBING STEEL AND SEAMLESS STEEL

National Tube Co., Pittsburgh, Pa.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Timken Roller Bearing Co., Canton, O.

TUMBLING BARRELS

Baird Machine Co., Bridgeport, Conn.

TUNGSTEN CARBIDE

Carboly Co., Inc., Detroit, Mich.

TURRET ATTACHMENTS

McCrosky Tool Corp., Meadville, Pa.

TURRET LATHES, VERTICAL

Bullard Co., Bridgeport, Conn.

TWIST DRILLS

See Drills, Twist.

UNIVERSAL JOINTS

Boston Gear Works, Inc., North Quincy, Mass.

VALVES, HYDRAULIC

Crankschaft Mch. Co., 320 No. Jackson St., Jackson, Mich.
Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago.
Oilgear Co., Milwaukee, Wis.

V-BELTS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

VISES, BENCH

Desmond-Stephan Mfg. Co., Urbana, O.
New Britain Gridley Machine Co., New Britain, Ct.

VISES, MACHINE

Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago.
Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
Graham Mfg. Co., Providence, R. I.
LoBlond, R. K., Machine Tool Co., Cincinnati, O.
Purvis, Edw., & Son, 110 York St., Brooklyn, N. Y.

VISES, PIPE

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Williams, J. H. & Co., 75 Spring St., New York City.

VISES, PLANNER AND SHAPER

Graham Mfg. Co., Providence, R. I.

VOLTMETERS

Bristol Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.

WASHERS

Boston Gear Works, Inc., North Quincy, Mass.

WASHERS, LOCK

Columbia Nut & Bolt Co., Inc., Bridgeport, Ct.

WASTE AND WIPING CLOTHS, RECLAIMERS

Oakite Products, Inc., 20 Thames St., New York City.

WELDING AND CUTTING GASES

Linde Air Products Co., 30 E. 42nd St., New York.

WELDING EQUIPMENT, ELECTRIC ARC

General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

WELDING MACHINES, ELECTRIC

Eisler Engineering Co., Inc., Newark, N. J.

WELDING RODS

Revere Copper and Brass Inc., 230 Park Ave., New York, N. Y.

WHEELS, STEEL, R.R. AND INDUSTRIAL

Carnegie Steel Co., Pittsburgh, Pa.

WIRE, FLAT AND ROPE

Roebbing's, John A. & Sons Co., Trenton, N. J.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.
Wickwire Spencer Steel Co., 41 E. 42nd St., New York.

WIRE NAIL MACHINERY

Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

WIRE, SPRING

Wickwire Spencer Steel Co., 41 E. 42nd St., New York.

WIRE WORKING MACHINERY

Baird Machine Co., Bridgeport, Conn.

WOODWORKING MACHINERY

Barnes, W. F. & John Co., Rockford, Ill.
New Britain Gridley Machine Co., New Britain, Ct.
Seneca Falls Mch. Co., Seneca Falls, N. Y.

WRENCHES

Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago.
Greene, Tweed & Co., 109 Duane St., New York City.
Standard Tool Co., Cleveland, O.
Williams, J. H. & Co., 75 Spring St., New York City.

WRENCHES, PIPE

Greene, Tweed & Co., 109 Duane St., New York City.
Greenfield Tap & Die Corp., Greenfield, Mass.
Starrett, L. S., Co., Athol, Mass.
Williams, J. H. & Co., 75 Spring St., New York City.

WRENCHES, TAP

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.

Morse Twist Drill & Machine Co., New Bedford, Mass.

Pratt & Whitney Co., Hartford, Conn.

Starrett, L. S., Co., Athol, Mass.

WRENCHES, RATCHET

Greene, Tweed & Co., 109 Duane St., New York City.

Williams, J. H. & Co., 75 Spring St., New York City.

ZINC

New Jersey Zinc Co., 160 Front St., New York City.
Ryerson, Joseph T. & Son, Inc., 2558 W. 16th St., Chicago, Ill.

QUIET

—"when it operated there was no noise to be heard above the low buzz of the motor"



LEIMAN BROS. AIR PUMPS
Gas Pumps, Air Motors
Not for pumping Liquids
PATENTED ROTARY TAKE UP THEIR OWN WEAR
NOISELESS used for paper feeders, gas machines, oil
POWERFUL burners, bottle fillers, milking machines.
EFFICIENT and other automatic and special machines.
MANY SIZES - VACUUM-PRESSURE
LEIMAN, INC. NEWARK, N. J.
LEIMAN BROS., N. Y. Corp.—23 Walker St.
Makers of good Machinery for 45 years

LONG LIVED

"—it has been running every day for 19 years, and it is going O K—"

Personal and efficient attention as
AGENTS IN GT. BRITAIN
is offered to American Machine Tool Makers by
E. H. JONES (Machine Tools) LTD.
Baldwin Terrace ♦ ♦ ♦ London, N. 1
who have established and made famous in that country
several makes of American and European Machines

One of our directors
will be attending the
**CLEVELAND
EXPOSITION**
Get in touch with him
care
F. W. JAEGER
140 Liberty Street
New York City

Alfred Herbert Ltd.

Coventry, England

The best organization in the World for the sale of high class machine tools and equipment.
Representatives are practical shop-trained engineer salesmen who know what they are talking about.
Offices and showrooms at:—London, Coventry, Paris, Brussels, Milan, Calcutta, Bombay, Sydney, Melbourne, Osaka, Tokyo, Johannesburg and Buenos Aires
Immediate attention to correspondence.

The Pronto Quick Operating and Wide Opening Lever Vises

Designed for Milling and Drilling Machines and are especially adapted for any work where a large number of pieces are to be quickly handled. **MADE IN THREE SIZES.**



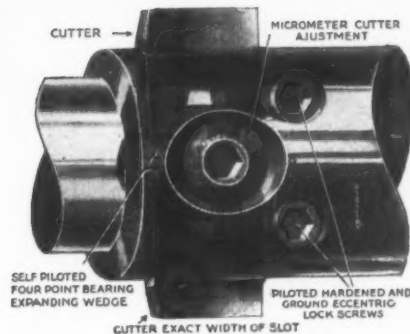
No. 1 6 3/4" long-8 lbs. \$50.00
No. 1 1 3/4" 2 3/4" long-17 lbs. \$60.00
No. 2 9 3/4" long-33 lbs. \$70.00
Prices subject to discount of 45%

Manufactured by

EDW. PURVIS & SON

110 YORK ST. Successor to Carter & Hakes BROOKLYN, N. Y.

DAVIS BORING TOOLS



For Accuracy-Speed-Economy

The exclusive use of Davis "L" Type Micrometer Expansion Boring Tool for all rough, semi-finish and finish boring operations will result in highly increased production at a saving of approximately 50% in cost. Write for Bulletin No. 102

DAVIS BORING TOOL CO., INC.

Division: Larkin Packer Co.

6200 Maple Ave.

ST. LOUIS, MO.

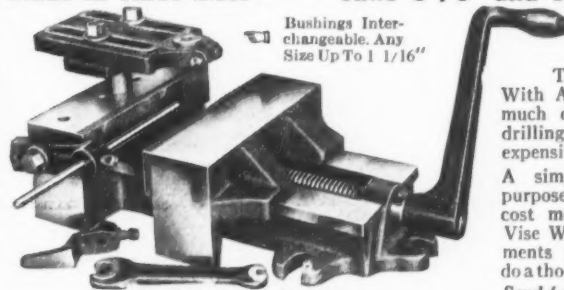
For
DRILL
PRESS

WISE

Often Used
on MILLER,
SHAPER or
PLANER

WITH and WITHOUT JIG ATTACHMENTS

Made in Three Sizes — Jaws 6", 9" and 12" Long



Bushings Interchangeable. Any Size Up To 1 1/16"

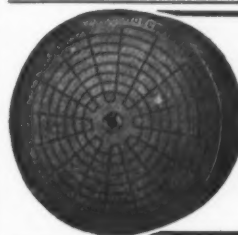
A Good Plain Vise

THEN
With Attachments much duplicate drilling without expensive Jigs.

A simple single-purpose Jig will cost more than a Vise With Attachments which will do a thousand jobs.

Send for Circulars

THE GRAHAM MFG. CO., PROVIDENCE, R. I.



Walker Magnetic Chucks

Sizes—Styles—for Every Class of Large and Small Work.

"The best way to hold most work, the only way to hold some of it." Send for a catalog.

O. S. WALKER CO., INC.
WORCESTER, MASS.

DO NOT LOSE THEIR TEMPER BECAUSE HIGH SPEED STEEL POINTS



THE READY TOOL COMPANY

550 Iranistan Ave.

Bridgeport, Conn.

ALPHABETICAL INDEX OF ADVERTISERS

A

| | |
|-----------------------------------|--------------|
| Abrasive Machine Tool Co. | 76 |
| Acme Machinery Co. | 79 |
| Allen-Bradley Co. | Back Cover |
| Allen Mfg. Co. | 102 |
| Allis-Chalmers Mfg. Co. | Insert 18-19 |
| American Gas Furnace Co. | 99 |
| American Metal Treatment Co. | 99 |
| Arguto Oilless Bearing Co. | 89 |
| Armstrong-Blum Mfg. Co. | 105 |
| Armstrong Bros. Tool Co. | 92 |
| Automatic Mch. Co. | 81 |

B

| | |
|--|-------------------|
| Baird Machine Co. | 80 |
| Baker Brothers, Inc. | 66 |
| Barber-Colman Co. | Insert bet. 66-73 |
| Barnes Drill Co. | Insert bet. 66-73 |
| Barnes, W. F., & John Co., Insert bet. 66-73 | |
| Baumbach, E. A., Mfg. Co. | 82 |
| Bennett Metal Treating Co. | 99 |
| Blanchard Machine Co. | 64 |
| Boston Gear Works, Inc. | 85 |
| Bridgeport Safety Emery Wheel Co., Inc. | 77 |
| Bristol Co. | 97 |
| Brown & Sharpe Mfg. Co., Front Cover, 59-89 | |
| Brown, E. C., Co. | 93 |
| Bryant Chucking Grinder Co. | 45 |
| Bryant Machinery & Engineering Co. | 83 |
| Buhr Machine Tool Co. | 74 |
| Bullard Co. | 26 |
| Bunting Brass & Bronze Co. | 90 |

C

| | |
|---|-----|
| Calder, Geo. H., Co. | 76 |
| Canedy-Otto Mfg. Co. | 74 |
| Carboloy Co., Inc. | 54 |
| Carborundum Co. | 30 |
| Card, S. W., Mfg. Co. | 103 |
| Carlton Machine Tool Co. | 74 |
| Chicago Wheel & Mfg. Co. | 98 |
| Cincinnati Gear Co. | 86 |
| Cincinnati Machinery & Supply Co. | 93 |
| Cincinnati Milling Machine Co. | 15 |
| Classified Advertisements | 93 |
| Cleveland Twist Drill Co. | 25 |
| Colton, Arthur, Co. | 92 |
| Columbia Nut & Bolt Co., Inc. | 106 |
| Columbus Die, Tool & Machine Co. | 91 |
| Cone Automatic Machine Co., Inc. | 79 |
| Consolidated Machine Tool Corp. of America | 80 |
| Conway Clutch Co. | 92 |
| Crankshaft Machine Co. | 92 |
| Cullman Wheel Co. | 87 |
| Cumberland Steel Co. | 41 |

D

| | |
|----------------------------------|-----|
| Davis Boring Tool Co., Inc. | 111 |
| Davis Keyseater Co. | 75 |
| Delta Mfg. Co. | 74 |
| Desmond-Stephan Mfg. Co. | 78 |
| Diamond Machine Co. | 78 |
| Diefendorf Gear Corp. | 86 |
| Dumore Co. | 76 |

E

| | |
|--------------------------------------|-----|
| Earle Gear & Machine Co. | 87 |
| Eastern Machine Screw Corp. | 103 |
| Eastern Machinery Co. | 93 |
| Eisler Engineering Co., Inc. | 90 |
| Emerman, Louis E., & Co. | 92 |
| Errington Mechanical Laboratory | 95 |
| Ex-Cell-O Aircraft & Tool Corp. | 51 |

F

| | |
|-----------------------------------|-----|
| Fafnir Bearing Co. | 32 |
| Federal Bearings Co., Inc. | 29 |
| Federal Products Corp. | 95 |
| Fellows Gear Shaper Co. | 6-7 |
| Foot-Burt Company | 73 |
| Ford Chain Block Co. | 90 |
| Fostoria Pressed Steel Corp. | 80 |

G

| | |
|---|-----|
| Gallmeyer & Livingston Co. | 77 |
| General Electric Vapor Lamp Co. | 101 |
| Geometric Tool Co. | 33 |
| Gisholt Machine Co. | 34 |
| Gits Bros. Mfg. Co. | 87 |
| Gorton, George, Machine Co. | 78 |
| Graham Mfg. Co. | 111 |
| Grant Gear Works | 86 |
| Grant Mfg. & Machine Co. | 82 |
| Greene, Tweed & Co. | 105 |
| Greenfield Tap & Die Corp. | 56 |
| Greenlee Bros. & Co., Insert bet. 66-73 | |
| Gwilliam Co. | 88 |

H

| | |
|-------------------------------------|-----|
| Hall Planetary Co. | 79 |
| Hamilton Mfg. Co. | 97 |
| Hannifin Mfg. Co. | 47 |
| Hardinge Brothers, Inc. | 48 |
| Hartford Special Machinery Co. | 86 |
| Haskins, R. G., Co. | 75 |
| Haynes Stellite Co. | 23 |
| Herbert, Alfred, Ltd. | 111 |

I

| | |
|-------------------------------------|---------|
| Illinois Steel Co. | 36 |
| Illinois Tool Works | 80 |
| Industrial Press | 107-109 |
| International Nickel Co., Inc. | 37 |

J

| | |
|--|-----|
| Johnson Bronze Co. | 91 |
| Jones & Lamson Machine Co. | 8-9 |
| Jones, E. H., (Machine Tools), Ltd. | 111 |

L

| | |
|---------------------------------------|-----|
| Landis Machine Co., Inc. | 4-5 |
| Landis Tool Co. | 24 |
| Langelier Manufacturing Co. | 81 |
| Larson & Son | 93 |
| LeBlond, R. K., Mch. Tool Co. | 31 |
| Leeds & Northrup Co. | 58 |
| Leiman, Inc. | 111 |
| Leland-Gifford Co. | 74 |
| Lincoln Electric Co. | 50 |
| Linde Air Products Co. | 55 |
| Link-Belt Co. | 49 |
| Littell, F. J., Machine Co. | 81 |
| Lodge & Shipley Machine Tool Co. | 2-3 |
| Loshbough-Jordan Tool & Mch. Co. | 81 |
| Lovejoy Tool Co., Inc. | 104 |
| Lovejoy Tool Wks. | 89 |
| Ludlum Steel Co., Insert bet. 66-73 | |

M

| | |
|---|---------|
| Machine Tool Show | 10-11 |
| Machinery | 107-109 |
| Madison-Kipp Corp. | 44 |
| Madison Mfg. Co. | 103 |
| Manufacturers' Consulting Engineers. | 83 |
| Marlin-Rockwell Corp. | 65 |
| Massachusetts Gear & Tool Co. | 86 |
| Materials Section | 35-42 |
| Mattison Machine Wks., Insert bet. 66-73 | |
| Merrell Manufacturing Co. | 82 |
| Miles Machinery Co. | 93 |
| Modern Machine Corp. | 104 |
| Moline Tool Co. | 75 |
| Morgan Engineering Co. | 90 |
| Morse Chain Co. | 61 |
| Morse Twist Drill & Machine Co. | 19 |
| Mummert-Dixon Co. | 90 |
| Murphy Machine & Tool Co. | 99 |

N

| | |
|--|-------|
| National Tube Co. | 63 |
| National Twist Drill & Tool Co. | 99 |
| New Britain-Gridley Mch. Co., Inside Front Cover | |
| New Departure Mfg. Co. | 13 |
| Niagara Machine & Tool Works. | 28 |
| Nicholson File Co. | 16 |
| Norma-Hoffmann Bearings Corp. | 95 |
| Norton Company | 52-53 |

O

| | |
|----------------------------|----|
| Oakite Products, Inc. | 97 |
| Oilgear Co. | 96 |
| Oliver Instrument Co. | 77 |

P

| | |
|------------------------------------|-----|
| Parker-Kalon Corp. | 43 |
| Perkins Mch. & Gear Co. | 84 |
| Philadelphia Gear Works | 87 |
| Poole Foundry & Machine Co. | 88 |
| Porter-Cable Machine Co. | 79 |
| Potter & Johnston Machine Co. | 78 |
| Pratt & Whitney Co. | 46 |
| Precision Tool Co. | 91 |
| Preis Engraving Machine Co. | 103 |
| Production Machine Co. | 76 |
| Purvis, Edw., & Son. | 111 |
| Pyroil Co. | 88 |

R

| | |
|--|-------|
| Ransom Grinding Mch. Co. | 77 |
| Ready Tool Co. | 111 |
| Revere Copper & Brass, Inc. | 40 |
| Rivett-Lathe & Grinder, Inc. | 78 |
| Rockford Drilling Machine Co., Insert bet. 66-73 | |
| Rockford Machine Tool Co., Insert bet. 66-73 | |
| Roebbling's, John A., Sons Co. | 42 |
| Roper, Geo. D., Corp. | 89 |
| Rowbottom Machine Co. | 80 |
| Russell Electric Co. | 95 |
| Ruthman Machinery Co. | 88 |
| Ryerson, Joseph T., & Son, Inc. | 35-38 |

S

| | |
|--|-----|
| Schatz Manufacturing Co. | 22 |
| Seneca Falls Mch. Co. | 57 |
| Shafer Bearing Corp. | 100 |
| Shepard Niles Crane & Hoist Corp. | 88 |
| Shore Instrument & Mfg. Co. | 95 |
| Sier-Bath Gear Co. | 87 |
| South Bend Lathe Works | 78 |
| Springfield Machine Tool Co. | 78 |
| Stahl Gear & Machine Co. | 84 |
| Standard Pressed Steel Co. | 103 |
| Star Machine & Engineering Corp. | 77 |
| Starrett, L. S., Co. | 27 |
| Stokerunit Corp. | 75 |
| Sundstrand Machine Tool Co., Insert bet. 66-73 | |
| Superior Die Casting Co. | 103 |
| Swaine, Fred J., Mfg. Co. | 83 |

T

| | |
|------------------------|-------|
| Taylor-Shantz Co. | 81 |
| Texas Company | 20-21 |
| Torrington Co. | 82 |

U

| | |
|--------------------------------------|--------|
| Union Carbide & Carbon Corp. | 23-55 |
| Union Twist Drill Co. | 12-103 |
| Universal Boring Machine Co. | 75 |
| Universal Engineering Co. | 99 |
| Used Machinery | 92-93 |
| U. S. Steel Corp. Subsidiaries. | 36-63 |
| U. S. Tool Company, Inc. | 82 |

V

| | |
|----------------------|----|
| V & O Press Co. | 82 |
|----------------------|----|

W

| | |
|-------------------------------------|-----|
| Walker, O. S., Co., Inc. | 111 |
| Walls Sales Corp. | 76 |
| Waltham Machine Works | 79 |
| Walton Company | 99 |
| Waterbury Steel Ball Co., Inc. | 91 |
| Watts Bros. Tool Works | 91 |
| White, S. S., Dental Mfg. Co. | 14 |
| Wickwire Spencer Steel Co. | 39 |
| Wiesman Mfg. Co. | 83 |

Z

| | |
|--------------------------|----|
| Zeh & Hahnemann Co. | 82 |
|--------------------------|----|

